Cornell Nature-Study Leaflets, 1896 to 1956

Eva L. Gordon

Sixty years ago, in December 1896, Cornell University published the first of a long series of leaflets designed to be of help in the teaching of nature-study in the schools. With this issue, one of these publications, the *Cornell Rural School Leaflet*, enters its fiftieth volume. It seems fitting, therefore, to recognize both of these milestones in the September 1956 Teachers' Leaflet. We have brought together materials from earlier leaflets, chosen with two purposes in mind: first, to recall (or to introduce) to 1956 readers some of the persons who helped to build the Leaflet service and to carry it through the years; and, second, to provide, through these earlier writings, suggestions that we believe many teachers of today will find useful in their nature and science programs of 1956-57.

When that first leaflet was written by Liberty Hyde Bailey for the teachers of the State, nature-study teaching at Cornell University was already well under way. Through extension work with both adults and children, its value as an aid to agriculture had come to be recognized. Leaders were convinced that "the greatest good which can be rendered to the agricultural communities is to awaken an interest in nature-study on the part of teachers and children." (*Agricultural Extension Work: Sketch of its Origin and Progress*, Bulletin 137, May, 1897, Cornell University Agricultural Experiment Station, Ithaca, New York.) The first appropriation of $8,000 had been granted by the State to the College of Agriculture in Cornell University to further the teaching of nature-study in the rural schools. School visitation and experiments in teaching nature-study in the schools had encouraged the leaders of the movement to believe that most teachers were willing to undertake the work if they "could be instructed in the proper methods." At the suggestion of John W. Spencer (page 18), printed leaflets were adopted as one of several means to establish nature-study in the schools.

Further information on the history, scope, and philosophy of the nature-study work at Cornell may be found in the references listed on page 63.

A Chronology of Cornell Nature-Study Leaflets, 1896 to 1956

Teachers' Leaflets

With his leaflet *How a Squash Plant Gets out of the Seed* (pages 10 to 14), Liberty Hyde Bailey inaugurated what he termed "a series of leaflets . . . dealing with common things, which may be put in the hands of teachers, and, when desired, of pupils as well." He further commented (*Second Report upon Extension Work in Horticulture,* Bulletin 122, December, 1896, Cornell University Agricultural Experiment Station, Ithaca, New York), "We have preferred that these little texts be not read to the pupils as stories, but that they shall answer as suggestions to the teachers who shall have the children perform the simple experiments and make the direct observations which are indicated."

From December 1896 to February 1899, 13 of these leaflets were issued. Kept in print and "sent free to all engaged in teaching in the public schools of the State of New York," they were reaching a mailing list of 25,000 by June 1899. The list which follows indicates the type and variety of subject-matter covered. The authors were fellow staff-members, a precedent for many years of cooperative effort in preparing simply-written, authoritative material for use in the public schools.

1. How a Squash Plant Gets out of the Seed. L. H. Bailey
2. How a Candle Burns. George W. Cavanaugh
3. Four Apple Twigs. L. H. Bailey
4. A Children's Garden. L. H. Bailey
5. Some Tent-Makers. Anna Botsford Comstock
6. What is Nature-Study? L. H. Bailey
7. Hints on Making Collections of Insects. Anna Botsford Comstock
8. The Leaves and Acorns of Our Common Oaks. Alanson Phelps Wyman
9. The Life History of the Toad. Simon Henry Gage
10. The Birds and I. L. H. Bailey
11. Life in an Aquarium. Mary Farrand Rogers
12. How the Trees Look in Winter. L. H. Bailey
    One Way of Drawing Trees in Their Winter Aspects. Charles W. Furlong
13. Evergreens and How They Shed Their Leaves. H. P. Gould

Nature Study Quarterly

The nine issues of this series (the first titled *Nature-Study Bulletin)* were published from June 1899 to May 1901. In these nine pamphlets, nine more of the earlier series of *Teachers' Leaflets* were presented, together with lessons for children, and various "notes of instruction, explanation, and advice, and letters from the friends of the movement." L. H. Bailey stated in the first issue: "Our entire movement in nature-study is

for the benefit of the children. We are now making an effort to reach them directly, as well as through the teacher, the parent, the garden, and the flower show. We have long had correspondence with many children . . . we are now inaugurating a definite effort at the organization of nature-clubs amongst the children of the State." Professor Bailey commented further: "This nature-study movement has grown to large proportions . . . proof that it is needed and is founded upon correct principles." He voiced again the purpose of the movement: "The animus of the endeavor is to cause the child to love nature and thereby to be content with country life. There is no other corrective of agricultural ills than this. Contentment and happiness are results of thinking; and one thinks much when he sees much."

Junior Naturalist Monthly

The nature clubs mentioned by Professor Bailey in the June 1899 *Cornell Nature-Study Bulletin* were the special responsibility and joy of John W. Spencer (page 18). Known as *Junior Naturalist Clubs*, they were organized under the direction of one teacher in each grade or school. Their purpose was to help the teachers by interesting the pupils in the world around them. Dues consisted of letters to Mr. Spencer "once or twice a month," describing their outdoor observations and activities. Upon evidence from their leader of satisfactory organization and accomplishment, each club was awarded a charter, and club members won the right to wear a badge or button—in Uncle John's words, as "badges of honor and not to be cheapened by being worn by the undeserving." By the end of 1898, 35,000 members were enrolled. During some years hundreds of clubs were in operation—808 were in existence in 1908 when the organization was terminated.

With as many as 30,000 Junior Naturalists in a single year, individual acknowledgment of "dues" was impossible. At first Mr. Spencer wrote friendly circular letters in response to his correspondence, addressing them to "my dear nieces and nephews," and signing them "Uncle John." In October 1899, the first 4-page printed Junior Naturalist Club Lessons went out. A little later this publication became the *Junior Naturalist Monthly*, the "official journal" of the Clubs until they went out of existence in 1908. Alice G. McCloskey (page 35) was brought to Cornell in 1899 to help in this part of the work, and later Ada Georgia (page 28) joined the staff. The Junior Naturalist Clubs brought thousands of children into direct communication with the University, and the *Monthly* carried to club members simply written information about common things, bits of friendly philosophy, suggestions of things to do and to see, and directions for simple experiments.

The Home Nature-Study Course

An announcement in the June 1899 *Nature-Study Bulletin* recorded the establishment of a *Home Nature-Study Course* for teachers "for the benefit of those who wish to carry on a line of study in connection with their teaching, and through vacation, but who cannot undertake the work of a summer school." Developed by Mrs. Mary Rogers Miller (page 44), the *Home Nature-Study Course* was a non-credit correspondence course, each "lesson" consisting of an informative article (sometimes one that had already been published by the Bureau of Nature-Study, of which L. H. Bailey was chief, and John W. Spencer, assistant chief) and a quiz, to be answered and returned, but to be "regarded as a report of progress and not as an examination." In a note in the *Nature-Study Quarterly* for October 1899, Mrs. Miller offered suggestions as worthy of attention today as they were when she wrote:

"Just a word with you about the Home Nature-Study. It is not primarily a reading course. The pamphlets sent you are full of suggestions for you to follow, experiments for you to perform, work for you to do. Unless you actually do these things, you fail to make the experiences your own, you take statements on authority, and miss the point of the whole course. Reading what others have observed about nature, lacks the freshness and freedom of original investigation. Without the element of discovery and personal contact, nature-study deteriorates into lesson-getting. Seeing nature with other people's eyes, reading their thoughts about her ways, is most delightful, after one has seen and thought for one's self."

When Mrs. Miller left Ithaca, in 1903, 29 lessons had been prepared and published, and nearly 3000 students were enrolled. After a brief period during which Mrs. Miller's sister, Julia Ellen Rogers, carried on the work, Mrs. Anna Botsford Comstock took it over. From 1903 until 1911, she continued the *Home Nature-Study Correspondence Courses*, with the assistance (after 1906) of Miss Ada Georgia (page 28). By 1906, 26,830 persons were enrolled. The material prepared for this work became the nucleus of Mrs. Comstock's well-known *Handbook of Nature Study*. First published in 1911, this book is now in its 24th edition, and still enjoys wide sales.

The Cornell Rural School Leaflet

It is difficult to summarize briefly fifty years of a publication. Changes in personnel entrusted with its preparation, changing needs and purposes, changing conditions, and changing ideas as to what constitutes good leaflets, all have come into play.

The *Cornell Rural School Leaflet* from its beginning in September 1907

Be it Hereby Known That,

The Fishkill

Junior Naturalist Club

No. 2034 of Newfield N. Y.

Is organized under the care and direction of the

Cornell University

COLLEGE OF AGRICULTURE,

And that *its purpose is the* Study of Nature, *to the end that every Member thereof shall love the country better and be content to live therein;*

And Further, That *this Document is a Chattel acknowledging said Club to be a part in the Extension Work in Agriculture, inaugurated under the Laws of the State of New York.*

Given under our Hand and Seal, this Twentieth *day of* December, 1901, *at* Ithaca, N. Y.

CORNELL JUNIOR NATURALIST CLUB

L. H. Bailey Chief.

Jno W Squires Deputy Chief.

A Junior Naturalist Club's Charter

until the fall of 1912, was edited by Miss Alice G. McCloskey (page 35). From November 1912 until Miss McCloskey's death in October 1915, she and Edward M. Tuttle (page 39) shared the editorship, which then fell to Mr. Tuttle until he resigned in October 1918. In accordance with a policy announced in Volume I, number 1, by Professor Bailey, then Dean of the New York State College of Agriculture at Cornell University, the new publication, while continuing to emphasize the fundamental "general nature-study outlook" was to "extend the agricultural applications" of the subject. This change meant publication of strictly "nature-study agriculture," written by experts, and generally planned to follow the state syllabus in nature-study and elementary agriculture. Material on school gardening was extensive, and, in later years, articles on homemaking were a part of most Leaflets. But Miss McCloskey and Mr. Tuttle found space for bits of poetry, quotations from literature, suggestions for reading, inspirational chats, nature-study materials of their own preparation or contributed by other workers in the field, and many letters—from teachers, from children, and to children. Leaflets of this period varied in length from a few pages to more than 400. Until 1911 they were issued in what Professor Palmer (page 53), in the *Teacher's Leaflet* for September 1944, called a "maze of teachers' numbers, children's numbers, series, new series, and supplements." But, from 1912 on, except for 1918-19, four numbers have appeared each year, of which the first issue for each school year is for teachers, the others for children.

During the World War I year 1918-19, Professor R. M. Stewart, of the Department of Rural Education, added responsibility for the Leaflet to his other duties. Only the teachers' number was published.

In the fall of 1919, Professor E. Laurence Palmer (page 53) began his long period of service, which ended with his retirement in the summer of 1952. Professor Palmer's own record of these years is still available on request in the *Teachers' Leaflet* for Fall 1952. A list of the Leaflets published from January 1920 to September 1956, is on pages 63 and 64. Perhaps the greatest changes in the Leaflet program under Professor Palmer's direction were decreased emphasis on correspondence with Leaflet users, the dropping of articles on practical agriculture and on homemaking as other agencies became responsible for such work; and, by long-range planning, the steady building up of a comprehensive body of reference material and suggestions for direct experience in the biological, physical, and earth science aspects of elementary-school science, with particular attention to ecology and conservation.

From 1952 to the present, the Leaflets have been the responsibility of Professor Eva L. Gordon. Beginning with the Winter 1956-57 number, Associate Professor Verne N. Rockcastle will be in charge.

The First Leaflet

LIBERTY HYDE BAILEY

"To encourage nature-study in rural schools" became a state-supported responsibility of the College of Agriculture in 1896. After a year of planning and testing ways and means, Professor Isaac P. Roberts, dean of the College, placed the whole enterprise in the hands of Liberty Hyde Bailey, then head of the Department of Horticulture.

Of Dr. Bailey's appointment, Mrs. Anna Botsford Comstock wrote, in the *Cornell Rural School Leaflet* for September 1923: "No wiser step could have been taken. Professor Bailey is a great man from any standpoint, but perhaps his greatness is never more in evidence than in his genius for leadership. He had great vision concerning this nature-study movement, and great faith, also. I think a stump or a stone would have come to efficient activity, had he chosen it as a helper in the work."

Professor Bailey (1858 to 1954) was born and spent his boyhood on a farm (in Michigan, near South Haven). After graduation from the newly-established Michigan Agricultural College, he studied with the renowned botanist, Asa Gray, at Harvard; then returned to his alma mater to teach and to develop one of the first departments of horticulture in any college. He came to Cornell in 1888, as a member of the Department of Horticulture. He served brilliantly as dean of the College of Agriculture from 1903 until 1913, when he retired to spend the remainder of his long life in botanical research and in writing about plants.

Professor Bailey's contributions to the success of the nature-study movement, at Cornell and elsewhere, were many and notable. He not only entered personally into many phases of the work, but drew cooperation and support from both scientists and educators. His philosophy is perhaps most completely expressed in two of his books, *The Nature-Study Idea*, 1903, and *The Outlook to Nature*, 1905.

TEACHER'S LEAFLETS No. 1.

FOR USE IN THE RURAL SCHOOLS. DEC. 1, 1896.

PREPARED BY

THE AGRICULTURAL EXPERIMENT STATION
OF CORNELL UNIVERSITY,
ITHACA, N. Y.

Issued under the auspices of the Experiment Station Extension, or Nixon Law. By L. H. BAILEY.

How a Squash Plant Gets Out of the Seed[1]

By L. H. Bailey

Figure 1 Squash plant a week-old

If one were to plant seeds of a Hubbard or Boston Marrow squash in loose warm earth in a pan or box, and were then to leave the parcel for a week or ten days, he would find, upon his return, a colony of plants like that shown in Figure 1. If he had not planted the seeds himself or had not seen such plants before, he would not believe that these curious plants would ever grow into squash vines, so different are they from the vines which we know in the garden. This, itself, is a most curious fact—this wonderful difference between the first and the later stages of nearly all plants, and it is only because we know it so well that we do not wonder at it.

It may happen, however—as it did in a pan of seed which I sowed a few days ago—that one or two of the plants may look like that shown in Figure 2. Here the seed seems to have come up on top of the plant; and one is reminded of the curious way in which beans come up on the stalk of the young plant. If we were to study the matter, however—as we may do at a future time—we should find a great difference in the ways in which the squashes and

[1]Reprinted with slight revisions from *Cornell Nature-Study Leaflets*, a 607-page collection of leaflets, from 1896 to 1904, published by the New York State Department of Agriculture.

Figure 2
Squash plant which has brought the seed-coats out of the ground

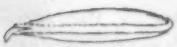


Figure 3
Germination just beginning

Figure 4
The root and the peg

the beans raise their seeds out of the ground. It is not our purpose to compare the squash and the bean at this time, but we are curious to know why one of these squash plants brings its seed up out of the ground whilst all the others do not. In order to find out why it is, we must ask the plant, and this asking is what we call an experiment. We may first pull up the two plants. The first one (Figure 1) will be seen to have the seedcoats still attached to the very lowest part of the stalk below the soil, but the other plant has no seed at that point. We will now plant more seeds, a dozen or more of them, so that we shall have enough to examine two or three times a day for several days. A day or two after the seeds are planted, we shall find a little point or rootlike part breaking out of the sharp end of the seed, as shown in Figure 3. A day later this root part has grown to be as long as the seed itself (Figure 4), and it has turned directly downwards into the soil. But there is another most interesting thing about this germinating seed. Just where the root is breaking out of the seed (shown at *a* in Figure 4), there is a little peg or projection. In Figure 5, about a day later, the root has grown still longer, and this peg seems to be forcing the seed apart. In Figure 6, however, it will be seen that the seed is really being forced apart by the stem or stalk above the peg for this stem is now growing longer. The lower lobe of the seed has attached to the peg (seen at *a*, Figure 6), and the seed-leaves seem to be backing out of the seed. Figure 7 shows the

Figure 5
Third day of root growth

Figure 6
The plant breaking out of the seed

Figure 7
The operation further progressed

Figure 8
The plant just coming up

seed a day later. The root has now produced many branches and has thoroughly established itself in the soil. The top is also growing rapidly and is still backing out of the seed, and the seed-coats are still firmly held by the obstinate peg.

Whilst we have been seeing all these peculiar things in the seeds which we have dug up, the plantlets which we have not disturbed have been coming through the soil. If we were to see the plant in Figure 7, as it was "coming up," it would look like Figure 8. It is tugging away in getting its head out of the bonnet which is pegged down underneath the soil, and it has "got its back up" in the operation. In Figure 9, it has escaped from its trap . . . It must now straighten itself up, as it is doing in Figure 10, and it is soon standing proud and straight, as in Figure 1. We now see that the reason why the "seed" came up on the plant in Figure 2, is that in some way the peg did not hold the seed-coats down (see Figure 13), and the expanding leaves, being pinched together must get themselves loose as best they can.

Figure 9
The plant liberated from the seed-coats

There is another thing about this interesting squash plant which we must not fail to notice, and this is the fact that these first two leaves of the plantlet came out of the seed and did not grow out of the plant itself. We must notice, too, that these leaves are much smaller when they are first drawn out of the seed-coat than they are when the plantlet has straightened itself up. That is, these leaves increase very much in size after they reach the light and air. The roots of the plantlet are now established in the soil and are taking in food which enables the plant to grow. The next leaves which appear will be very different from these first or seed leaves.

Figure 10
The plant straightening up

These later ones are called the true leaves. They grow right out of the little plant itself. Figure 11 shows these true leaves as they appear on a young Crookneck squash plant, and the plant now begins to look much like a squash vine.

We are now curious to know how the stem grows when it backs out of the seeds and pulls the little seed-leaves with it, and how the root grows downward into the soil. Now let us pull up another seed when it has sent a single root about two inches deep into the earth. We will wash it very carefully and lay it upon a piece of paper. Then we will lay a ruler alongside of it, and make an ink mark one-quarter of an inch from the tip, and two or three other marks at equal distances above (Figure 12).* We will now carefully replant the seed. Two days later we will dig it up, when we shall most likely find a condition somewhat like that in Figure 13. It will be seen that the marks E, C, B, are practically the same distance apart as before and they are also the same distance from the peg AA. The point of the root is no longer at DD, however, but has moved on to F. The root, therefore, has grown almost wholly in the end part.

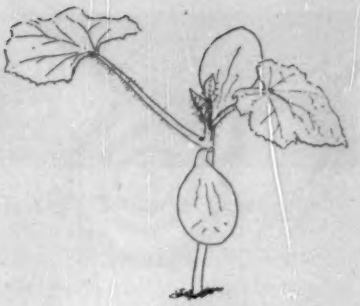


Figure 11
The true leaves developing

Figure 12
The marked root (Figure 12) shows that roots grow in the end portions (Figure 13)

Figure 13

*NOTE—Common ink will not answer for this purpose because it "runs" when the root is wet; indelible ink, used for marking linen or for drawing, should be used. It should also be said that the root of the common pumpkin and of the summer bush squashes is too fibrous and branchy for this test. It should be stated also that the root does not grow at its very tip, but chiefly in a narrow zone just back of the tip; but the determination of this point is rather too difficult for the beginner, and, moreover, it is foreign to the purpose of this tract.

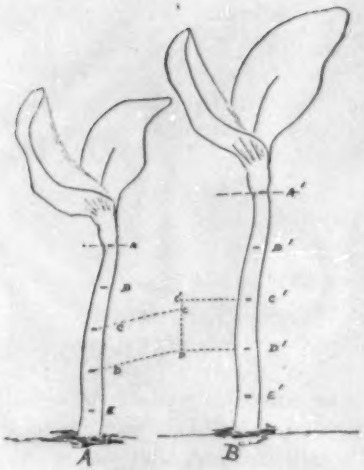


Figure 14
The marking of the stem, and the spreading apart of the marks

Now let us make a similar experiment with the stem or stalk. We will mark a young stem, as at A in Figure 14; but the next day we shall find that these marks are farther apart than when we made them (B, Figure 14). The marks have all raised themselves above the ground as the plant has grown. The stem, therefore, has grown between the joints rather than from the end. The stem usually grows most rapidly, at any given time, at the upper or younger part of the joint (or internode); and the joint soon reaches the limit of its growth and becomes stationary, while a new one grows out above it.

* * *

Natural science consists in two things—seeing what you look at, and drawing proper conclusions from what you see.

* * *

All the senses should be so trained and adjusted that all our world becomes alive to us. Then we are really sensitive.

* * *

The child should first come in contact with things rather than with ideas about things.

Editor's note: The articles on pages 15 to 52 are grouped according to seasonal appropriateness. They were chosen, not as the best writing of any author, but as representative of the approach of each author and of the style of the various publications. Most have been slightly revised.

Fall Studies

I. Anna Botsford Comstock

Even before organized work in nature-study came into being at Cornell, Mrs. Anna Botsford Comstock (1854 to 1930) was engaged in leading both adults and children to know and appreciate the world around them. First as a volunteer worker and then (after 1898) as the first woman to join Cornell University's faculty, she was active for more than a quarter of a century, teaching, lecturing, writing, illustrating, and contributing in many less concrete ways to the work in which she so heartily believed.

L. H. Bailey, her associate for many years, said of her in the *Cornell Rural School Leaflet* for September 1923: "She came to the work with three characteristics—accurate and extensive knowledge of her subject matter, clear knowledge of the situation in the schools, and a warm personality. During all the years in which she has blessed the enterprise, these attributes have been dominant. Under such an example and leadership, the movement could not fail."

Anna Botsford was born and grew up on a farm in Cattaraugus County, New York, near Otto. After graduation from Chamberlain Institute in Randolph, she taught for a year, then, in 1875, entered Cornell University. Three years later, on Cornell's tenth anniversary, she married the young entomologist, John Henry Comstock. To help in his work she learned wood engraving, a skill in which she excelled. In 1885, she reentered the University and took her bachelor's degree.

Her *Home Nature-Study Course* and her *Handbook of Nature-Study* (page 6) represented perhaps her most important writing, but she contributed also to other Cornell nature-study publications of her time, and to periodicals, particularly *The Nature-Study Review*, which she edited from 1917 to 1923. She wrote several books, including a novel.

October, 1900.

Junior Naturalist Monthly.

Issued by the College of Agriculture and Experiment Station of Cornell University, under Chapter 430 of the Laws of 1899, of the State of New York.

Entered in the Post Office at Ithaca, N. Y., as second class matter

CORNELL UNIVERSITY, ITHACA, N. Y. VOL. II. NO. 9

The Artist of the Nasturtium

By Anna Botsford Comstock

"And there's never a blade or a leaf too mean
To be some happy creature's palace."—*Lowell*

"SOME leaves have pictures of snakes on them," said little Jack as he presented me with a nasturtium bouquet.

"Who makes the pictures?" I asked.

"Nobody," he responded promptly.

"Hold one of the leaves up between your eyes and the light and look at one of the snake pictures," I suggested.

After a moment of close observation he shouted: "There is something alive in the head of the snake! I can see it move! What is it?"

I was obliged to confess that I did not know what it was. And so I concluded to ask the Junior Naturalists to help me find out the cause of these strange markings on the nasturtium leaves, and the way they are made. The questions, "What?" "How?" and "What for?" always confront the true naturalist.

I will tell you all that I know about these queer pictures on the nasturtium leaf; then I shall expect every true Junior Naturalist who has access to a nasturtium plant to help me discover the rest of the story.

All that I know is that this strange pattern in the leaf is made by a leaf miner, a very small insect that spends most of its life burrowing in the substance that lies between the upper and lower surfaces of the leaf.

The mother of the leaf miner has wings, but whether she has two or four wings, I do not know: if she is a fly she has two; if she is a moth she

has four. Sometime during the summer she laid an egg on the leaf; from this egg there hatched a little larva, a worm-like creature, that began at once to burrow in the leaf. This is all I know.

Will the Junior Naturalists answer some or all of the following questions, not by reading books nor by guessing, but by actual observations?

1st. Why does the insect make a mine in the leaf?
2d. How long does the miner live in the leaf?
3d. Why is one end of the mine larger than the other?
4th. Is the mature insect a fly or a moth?
5th. How does the mature insect escape from the mine? Is the hole through which it escapes in the upper or lower surface of the leaf?
6th. Do you find similar mines in the leaves of other plants than the nasturtium? If so, press some of these leaves and send them to us. (To Uncle John.)
7th. Make some drawings of the mines you find in nasturtium leaves and send them to us.

The way to capture the adult insect is to find leaves containing the living miners. Let these leaves remain on the plant and place over each a little bag of cheese cloth or thin muslin, and tie the mouth of the bag closely around the stem of the leaf. Thus when the winged insect emerges, it is caught in the bag and cannot fly away.

Send us any insects you have captured in this way. They may be put in a small paste-board or wooden box and mailed to us. Wrap the box securely in strong paper. You will not need to provide air holes, for there will be air enough in the box.

Questions 1, 3, 4, 5, 6, 7, may be answered this autumn. But question 2 and possibly question 4 may be answered next summer.

If the Junior Naturalists complete this study, it will be the first time the whole story of the nasturtium leaf miner has been told to the world.

* * *

Mrs. Comstock believed that stories of this type "should not be told as a finality or as a complete picture but as a guide and inspiration for further study . . . My story had left something interesting for the young naturalists to discover . . . There is not a weed or an insect or a tree so common that the child, by observing carefully, may not see things never yet recorded in scientific books." *(Handbook of Nature-Study.)*

* * *

Nature-study . . . consists of simple, truthful observations that may, like beads on a string, finally be threaded upon the understanding and thus held together as a logical and harmonious whole.—Mrs. Anna B. Comstock, in "The Handbook of Nature-Study."

II. John Walton Spencer

John W. Spencer (1843 to 1912), known to thousands of New York State children as "Uncle John," was born in Cherry Valley, New York, but lived in Westfield, Chautauqua County, for most of his life. As a young man he traveled west to San Francisco, and by sailing vessel to the Sandwich (the Hawaiian) Islands, where he spent a year and a half. Soon after his return to farm life in Chautauqua County he became interested in promoting state help to farmers in methods of farming. Through his efforts, Cornell extension work in horticulture began. He joined the Cornell staff in 1896, at first as a volunteer without salary. His work was the supervision of the Cornell Reading Course for Farmers.

When the appropriation for introducing nature-study into the schools came to the College of Agriculture, he was asked to help by visiting schools to learn needs and to discover ways of meeting them. There he found himself in his true element. He was a genius in helping teachers and in interesting and instructing pupils. Junior Naturalists clubs (page 5) and Junior Gardeners clubs (page 49) were developed under his direction. Both these organizations were extraordinarily successful, and brought thousands of New York State children into contact with the College of Agriculture. The Junior Naturalist movement spread to other states and to several foreign countries.

So it came about that Albert W. King, also of Westfield, wrote many years later: "Correspondence and personal contact with 'Uncle John' Spencer enriched the lives of many adults and children who were living in New York State around the turn of the century. He did much to improve the lot of the New York farmer by setting up a correspondence course for farmers, by providing speakers at educational farm meetings, and by work in the state horticultural society. Probably his greatest contribution, however, was the inspiration he gave to rural children through talks and letters to them on nature-study."

"Uncle John" retired to his beloved Bellwether Farm in 1908, but his interest in helping others to a better life was maintained to the end of his life.

October, 1899.

CORNELL
NATURE-STUDY QUARTERLY
No. 2.

Issued by the College of Agriculture and Experiment Station of Cornell University, under Chapter 430 of the Laws of 1899, of the State of New York. I. P. Roberts, Director

NOTES FOR JUNIOR NATURALISTS.

A BULB GARDEN

"It's rather dark in the earth today,"
Said one little bulb to his brother;
"But I thought that I felt a sunbeam ray—
We must strive and grow till we find the way!"
And they nestled close to each other.
Then they struggled and toiled by day and by night
Till two little snowdrops in green and white,
Rose out of the darkness and into the light,
And softly kissed one another.—*Boston Journal.*

A Bulb Garden

By John W. Spencer

To succeed with the cultivation of flowers, the first thing to have in mind is to make the plant comfortable. This condition should be not only the first thought, but also the last thought. If you can do this successfully, the plant will do the rest of the work and your results will be abundant.

What plant comfort is, is a question more easily suggested than answered, for it is a very large subject—about as large as the surface of the earth. As a venture we will say that there are as many different kinds of plants as there are people. It is at least safe to say that plants have as many different notions as to their conditions of life as have the people of the different nations and tribes of the world.

If you were to have a birthday party and should invite as your guests the children from the four corners of the earth, and by magic could bring them to you in a jiffy, the boys and girls from Greenland would come enfolded in seal-skin, and those from Hawaii would bring only their bathing suits. You would have a busy time keeping them comfortable, for when you opened the door to cool off the little Greenlanders, the little Kanakas would complain of too much draft; and at the table the former would ask if you happened to have some tallow candles for dessert, and the latter would ask for bread-fruit and bananas.

Many of our flowering plants have been brought together from such remote quarters as that. We have bulbs from Holland, and pansies from England, and phlox from the dry atmosphere of Texas.

There is as much difference in the conditions necessary for comfort in these different plants as there is in the requirements of the little Eskimos and little Polynesians. To some extent, plants can change their manner of living, but in the main they are happiest when they can have their own way, just as you and I are.

We cannot bring about the foggy, damp weather of Holland and England when we want it; neither can we bring the dry atmosphere of Texas—air so dry that meat will cure hard in the hottest weather without tainting. It so happens, however, that from one Fourth of July to the next we have many kinds of weather, and if one could not find conditions suited to almost any kind of plant it would be strange. If we cannot make the weather accommodate itself to the best comfort of the plant, we must set the plant so as to accommodate itself to the weather.

Pansies from foggy England and bulbs from the lowlands of Holland should be planted to bloom in the cool days of spring, and the phlox from Texas will prosper in the heat and drought of July and August.

With this idea well fixed in your mind, you will easily see that when you know the country from which a plant has come, a knowledge of the physical geography of that country will be helpful in knowing how to make the plant happy and prosperous.

We must also make the plant comfortable in the soil. There is great difference in what plants require to make them comfortable. Some, like thistles or mullein or ragweed, will thrive on almost any soil and are no more exacting as to food than a goat or a mule; but other plants are as notional as children reared in the lap of luxury. As a rule, flowering plants belong to the "lap-of-luxury" class.

The Snow-drop

Soil covers the land as thin skin covers an apple or as a thin coat of butter covers bread, and it holds more or less plant-food. When men erect school buildings and afterwards grade the ground, they usually turn a part of the soil upside down. There is also considerable rubbish of the builders left scattered about, such as brick-bats, chips of stone, and the like, that go to make the place an uncomfortable one for notional plants. For this reason I wish particularly to call your attention to the manner in which you should prepare the ground on which you intend to plant. The first thing to do is to spade the ground thoroughly to the depth of at least ten inches. All stones as large as a big boy's fist should be thrown out, and all lumps given a bat with the back of the spade to break them into fine particles. This is to be a flower-bed and should be soft like your own bed. It would be better to make it up more than once. After the first spading it would be well to cover the bed with a coat of stable fertilizer to a depth of six to eight inches, which will give additional plant-food; and in spading the second time, this fertilizer will become thoroughly mixed with the soil. The surface should next be raked smooth, and your flower-bed will then be ready for planting.

We all admire the bright bulb flowers that are among the first to blossom in the spring. These mostly come from Holland, or at least attain their perfection there. We have just spoken of the importance of

planting flowers at such a time that they may live their career when our climate is most like that from which they come. In the case of bulbs, spring and early summer is the most favorable time for them in this country, and fall is the proper time for planting.

The exact time in the fall to plant, how to plant, what bulbs to plant, when to put a winter overcoat on the bed, and other details, I will leave for Mr. Hunn to tell in the following Leaflet. He has had many years' experience in the management of flowers, and I advise you to read carefully what he says.

Notes to Junior Naturalists

Your Uncle wishes to speak to you about the letters he receives from his friends, the Junior Naturalists. At one time last spring (1899) the number was about two hundred each day. Every one of these was read. The ones written as payment of club dues were sorted out and given to a department where the letters, after a close reading, were passed to the credit of the writer. Those of a personal nature or asking information concerning some nature-study topic were handed to your Uncle for his perusal, and for him to answer, so far as he could. Do not think that any of your letters are thrown away without being read.

* * *

Whenever your Uncle meets in public a boy or girl wearing a Junior Naturalist Club button, he will speak to the wearer without any formality; and he thinks it a good plan if members will do the same thing. Let us feel that we belong to the same fraternity and all have the same interest in nature, and we will be friends to each other. He wishes to encourage a feeling of friendship among members of different clubs. When convenient, it will bring good results for one club to visit another, and the host club can show the guest club what it is doing in the study of nature.

* * *

We want every child to form a Junior Naturalist's Club, or to be a member of one. We wish it to be an actual and active club where you can help each other to see the common things about you. We want you to be real naturalists in a boy and girl way.

III. Mary Rogers Miller

The Opening of a Cocoon

(From the *Nature-Study Quarterly*, March 1900)

MONG the commonest treasures brought into the school by children in the fall or winter are the cocoons of our giant silk worms. If one has a place to put them where the air is not too warm or dry, no special care will be necessary to keep them through the winter. Out-door conditions must be imitated as nearly as possible. If early in the fall one is fortunate enough to meet one of these giants out for a walk, it is the simplest thing in the world to capture him and watch him spin his marvelous winter blanket. Two members of this family of giant insects are quite common in this state: the largest, the Cecropia, called sometimes the Emperor, and the Promethea. . . .

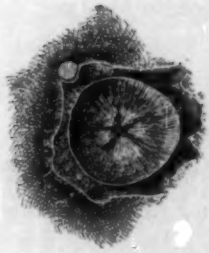
The Cecropia moth emerges from the cocoon, full grown, in early summer when out of doors. . . . The eggs are deposited by the adults upon apple, pear, cherry, maple and other shade and fruit trees. Professor Comstock says that the spiny caterpillars which hatch from the eggs in about two weeks, are known to feed upon the leaves of some fifty species of plants. . . .The full-grown caterpillar, having spent the summer eating and growing, with now and then a change of clothes, is often three inches long and an inch in diameter. It is a dull bluish green in color. On its back are two rows of wart-like protuberances (tubercles), some yellow, some red, some blue. . . .

Cocoon of the Cecropia moth

Photo by R. B. Fischer

The cocoon which this giant silk worm weaves is shown at the right. It may be found on a twig in some tree in the dooryard, but sometimes on a fence-post or equally unexpected place. Inside the cocoon the brown pupa, alive but helpless, waits for spring.

After the moth comes out, it is interesting to examine the structure



End of cocoon of Cecropia, inside view, showing where the moth gets out

of the cocoon, and to discover how the moth managed to free itself without destroying the silken blanket.

Swinging loosely from last summer's twig in lilac bushes, and on such trees as wild cherry and ash, one often finds the slender cocoons of the Promethea moth. We cannot help admiring the skill and care displayed by the spinner of this tidy winter overcoat. The giant silkworm which spun it chose a leaf as a foundation. He took care to secure himself against the danger of falling, by fastening the leaf to the twig which bore it by means of shining strands of silk. It is easy to test the strength of this fastening by attempting to pull it loose from the twig. . . .

The caterpillars of this species, the young Promethea, feed during the summer on leaves of wild cherry, ash and other trees. They grow to be about two inches long, and are distinguished from others by their pale bluish green color and yellow legs. They also have rows of wart-like elevations on their backs, some black and shining, four of a bright red and one large and yellow near the hindmost end.

The life of these giant insects is divided into four distinct stages: the egg, deposited by the adult moth usually on or near the food plant; the larva, or caterpillar stage, when most of the eating and all the growing is done; the pupa, passed inside the cocoon woven by the larva; and the adult, a winged moth.

The life cycle or generation is one year, the winter being passed in the pupa stage. The insect lives but a short time in the adult stage and the egg stage is but two or three weeks. Most of the summer is devoted to the caterpillar phase of its life.

Top, cocoon of Promethea-moth, fastened to a twig with silk; below, cocoon cut open lengthwise to show the valve-like device at upper end through which the adult moth pushes its way out

Winter Studies

I. Edward Mowbray Tuttle

About Reading

(From a *Letter to Boys and Girls,* Cornell Rural School Leaflet, January 1913.)

TODAY is the first sharp gray day that we have had and it is full of promise of winter, which will be at its height when you read this letter. Far away across the valley I can see the high hills with a light mantle of snow, so light that it almost disappears as I watch. Soon these hills of field and forest will be covered with a warm, thick blanket, underneath which the tender buds and shoots will rest in safety waiting for the spring to come and for the flowing sap to start their growth.

The days are now shortest of all the year. We get up before the sun, and at night lamps must be lighted ere supper time comes. But boys and girls do not mind. Warmly dressed, cheeks rosy with the cold, there is always time for a last slide down that long, shining hill in the gathering dark, or to put the finishing touches on that strong fort of snow which is to withstand the attack of the enemy next morning. At last it is time to go in, and a merry, breathless group shakes off the snow, removes caps and coats and boots and leggings, hovers for a minute near the warm kitchen stove, and finally settles down around the bright table for the evening meal.

After supper has been cleared away and a fresh log thrown on the open fire, there comes a time when most boys and girls like to curl up in a cozy chair and read. I wish that every one of you might form the habit of reading a little each day. Even if it is only for ten or fifteen minutes, this will amount to many hours in the course of a year. Books are the best of comrades. . . .

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II. Alice Gertrude McCloskey

The Snow Storm

The wind blows. The bare branches of the trees creak. The icy snow-flakes strike against the window and seem to call you out to enjoy the stormy January night. You think it would be fun to wrap up warmly and struggle against the wind for a little while, but you do not go. The wild night has a rival, a wood-fire, which has a coaxing way of keeping you near it. It roars and crackles and sends gay little sparks out of the chimney. It does its best to make you forget the storm. As the fire roars louder and louder, the tapping on the window seems fainter and after a time you cease to think of it.

The storm still decorates the landscape, however, while you sit indoors at your cheery fireside. In the morning you see the result of its work and you know that such an outdoor world has no rival. Every unsightly thing has disappeared. Yesterday you wished that the old ladder were not braced against the apple-tree; to-day you are glad it is there. Yesterday you objected to the clothes-line stretched across the garden; to-day you like to see the festoon between the grape-arbor and the tall white-capped post. Yesterday you wondered whether the mountain ash could be prettier than it was with its dusky background; to-day you know that it can.

You go into the woods. The stillness is almost solemn.

> "The pine is like a tall cathedral tower
> With oriels of withered ivy-vines
> Entwined in sculptured shapes of wreath and flower,
> Through which the clear, red stain of morning shines;
> And underneath, the snow-draped shrubs and briers
> Seem kneeling groups of silent, white-robed friars."

The poet does not speak of the persistent stems of the wood flowers, which stand erect and hold up the snow, but you notice them. Perhaps you find out what part of the plant is left to which the snow can cling.

As you walk on, past the spruces which seem to hold their snowy burden lovingly, and past the indifferent pines from which the soft covering is already beginning to fall, you notice that you are not the first traveler in the quiet white-clad woods. Burroughs says: "The snow is a great tell-tale and blabs as effectually as it obliterates. I go into the woods and know all that has happened. I cross the fields and if only a mouse has visited her neighbor, the fact is chronicled." You find that is true. Here, the little tracks in sets of four give a clue to Mollie Cottontail's private affairs. There, underneath the oaks the wild mice have been having a frolic. Their going and coming have been plainly marked. Your interest is awakened at once. You follow the foot-prints of these little wild creatures of the woods. Where were they scampering before you were up this bright morning?

The note of a chick-a-dee reaches your ear. This reminds you that the winter birds have not been very noisy to-day. A few are snuggled close together among the branches of the evergreens, but a chick-a-dee is on the wing. Dear little bird! It is indeed "a cold day" when its cheery song is not heard. You do not wonder that Hezekiah Butterworth said:

"I love the high heart of the osprey,
The meek heart of the thrush below,
The heart of the lark in the meadow,
And the snowbird's heart in the snow,
But dearer to me,
Chick-a-dee! Chick-a-dee!
Is that true little heart in the snow."

Every unsightly thing has disappeared

Photo by R. B. Fischer

III. Ada Eljiva Georgia

Ada E. Georgia (1858 to 1921) spent part of her childhood in Ithaca, where her father, a skilled stone mason, was employed in the construction of the first buildings of Cornell University. Later, Mr. Georgia became blind and his family was necessarily broken up. Ada found a home with the Stratton family on a farm near Elmira. There she became proficient in house work, attended district school, and, at about sixteen, decided to become a teacher, an ambition she achieved at twenty. She taught first in rural schools, then in Elmira. There "Uncle John" Spencer discovered her, and brought her to Ithaca to assist in the Junior Naturalist work.

Her wide knowledge of living things, especially plants, and her skill in teaching natural history made her a valuable aid to Mr. Spencer, and later (1906 to 1911) to Mrs. Comstock, in the *Home Nature-Study* work. From 1911, until a year before her death in 1921, she was an instructor in a course in the College of Agriculture, eventually known as the *Natural History of the Farm*. Her 600-page *Manual of Weeds*, published in 1914, was her most notable written contribution, but she wrote articles for the *Junior Naturalist Monthly* and prepared many of the lessons on vegetables and weeds for the *Home Nature-Study Course*.

She loved books, her one extravagance. During her years at Cornell, she amassed a remarkable natural-history library and one rich in standard literary works as well. Present-day staff and students still use books inscribed with the name Ada E. Georgia.

Mrs. Comstock said of Miss Georgia, in the *Cornell Rural School Leaflet* for September 1923: "Miss Georgia's life, if fully told, would be a tale of struggle and mastery of what would have seemed, to a less dauntless spirit, utterly insuperable obstacles. However, there was a quality in her that found joy in mastering adverse circumstances. She was a good soldier, and always ready to march to the firing line. She always faced what was coming, and never turned her back on a hard situation. That was the way she lived and that was the way she died; and her indomitable spirit, as well as her love of nature and of books, remains as a treasured legacy in the memory of all who knew her well."

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ALICE G. McCLOSKEY, Editor.

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Tracks In The Snow

By Ada E. Georgia

What a wonderful teacher and playfellow is the snow! When it first comes, how the children shout in anticipation of the good times they will have with it, snowballing, coasting, and building forts!

But did you ever go to it quietly and ask it to tell you some of the strange and wonderful things it knows? Sometimes it can tell most interesting stories and tell them very plainly. We like to read stories of the Indian hunters who follow "trails" so skillfully, but how came they to have such keen eyes? Yours and mine are probably just as good if only we knew how to look.

Let us see whether we can read a few tracks in the snow, taking the very easiest and nearest at hand. Can you tell your Malta cat's track from that of your neighbor's terrier whose feet are no larger? Look sharp!

Oh, yes; Puss draws back every claw in its sheath and leaves only the mark of a velvet pad with four toe dots in front. Nipper's nails do not retract and each leaves its mark in front of the toe. Also Malta's hind feet drop neatly upon the front paw's tracks, so that she seems to walk two-footed. Nipper cannot match his tracks like that.

Study the tracks of your chickens and pigeons and the birds of the street; even the tracks of different people are very interesting.

On my way home from school one winter evening, I saw the tracks of two persons which pleased me greatly; one of a tall man—I knew he was tall by the long steps—and beside these tracks were the mark of some wee rubber boots, trotting three steps to one. They were new rubber boots and I smiled as I pictured a little man wearing his first pair and going proudly out to meet father. Presently I turned a corner and came in view of the track-makers and the little man turned out to be a little girl. Do you not think she enjoyed wearing the new rubber boots as well as any boy would?

But it is this country lad who can play at trailing. About the poultry

yard comes the marauding skunk, fox, and weasel and every wood path tells a story—if the snow is just right.

I remember one March morning when a "sap snow" covered the ground and I was on my way through a little wood to a country school, I came across a most remarkable track. It looked just like a tiny baby's foot. The well-defined heel, the slender sole, each dainty separate toe—it was perfect! It led down to the recently thawed brook. Much puzzled I went on to school and asked my pupils about it, and there was a shout, "'Twas a coon! Oh, teacher, coons have waked up!"

Through the pastures and brush lots Bunny Cottontail goes; but look out that you do not trail him backward, for Bunny overreaches and at every jump plants his larger and longer hind feet well in front of the tracks made by his tiny forepaws.

Squirrels, with the exception of the ground squirrel, are ready to come out every warm spell and search for the nuts they have hidden. And mice! They are everywhere: especially along the edge of a millet field. They do not seem to take winter naps. They make miles of little runways through the grass under the snow, which are uncovered when it melts, and seem to have a social time above it as well, from their numberless tracks. Sometimes you catch sight of a mouse track that is perfect from each tiny claw mark to the knitting-needle scratch of mousie's little tail.

Do not fail to take walks in winter weather and question the snow. Keep a record of all the different tracks that you find. If you do not know what animal made the tracks, send us drawings of them. Perhaps we can tell you what they are.

The Willow

By Ada E. Georgia

(From the *Junior Naturalist Monthly*, February 1907)

Now is the time to study winter buds, for many of them begin to swell and show that they feel the "northing sun" as early as February; and a good way to make the study easy, is to gather small branches and bring them into the house for forcing in water. The warmth and light of a sunny window will help them to make immediate use of the food which the tree stored away in the summer past, and you may have leaves and blossoms long before the snow is gone out-of-doors.

You will be interested in the study of many kinds of trees, but one of the most attractive, and among the easiest to force, is the willow. There are many kinds, some large trees, and some only shrubs, but all are useful and attractive.

Observe closely the tree from which you gather twigs, its size, and the color of its bark—it is from the bark that the black willow takes its name. The silky willow's purple twigs and the golden osier's yellow ones will help you in like manner to know them. How many scales in the bud coverings? Do you find any at the very tips of the twigs? As the "pussies" grow some will cover themselves with golden or reddish fuzz according to the kind, and be as dusty as millers. Others will be small, and silvery green, with no dust or fuzz at all, yet apparently on the same kind of twig, though from different trees. This is true, and I hope you will remember to watch some of these small green catkins on the growing tree. In June or late May you will find that the little green catkins have grown large and are covered with rows of tiny pointed pods, which open just as milk weed pods do when ripe, and out float the tiny seeds, each borne up by the silken wings which carry them far from the parent tree.

When your twigs have been only a few days in water you will find that all the willows have put out rootlets and have begun to grow. Even if a twig happens to be wrong end up, if it has plenty of warmth and moisture, the rootlets will often form. This habit of taking root easily makes the willow most useful as a "soil-binder" when planted along the banks of streams that "wash" and overflow in flood-times. It has also other uses; its wood makes charcoal of the finest grain, which is therefore used in the manufacture of gunpowder. Perhaps your mother's clothes-basket or the baby's carriage is made of peeled willow withes, grown for the purpose by "pollarding" or cutting back the tree known as the basket willow. The wooden shoes worn by many of the working people of Europe are made of willow-wood, which is exceedingly light though tough when well seasoned. And we must not forget what fine whistles we can make as soon as the bark "slips" on the willows. It would be interesting to observe how long the whistle season lasts, between the time when the bark will "slip" and when it "binds."

Pollen-bearing catkins (left) and seed-bearing catkins (right) of Pussy Willow

Photo by R. W. Curtis

December. 1903.

Home Nature-Study Course

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Anna Botsford Comstock, Editor.

VOL. V. CORNELL UNIVERSITY, ITHACA, N. Y. NO. 3.

IV. Anna Botsford Comstock

The Chickadee

He is the hero of the woods; there are courage and good nature enough in that compact little body, which you may hide in your fist, to supply a whole groveful of May songsters. He has the Spartan virtue of an eagle, the cheerfulness of a thrush, the nimbleness of Cock Sparrow, the endurance of the seabirds condensed into his tiny frame, and there have been added a pertness and ingenuity all his own. His curiosity is immense, and his audacity equal to it; I have even had one alight upon the barrel of the gun over my shoulder as I sat quietly under his tree.—Ernest Ingersoll

HOWEVER careless we may be of our friends when we are in the midst of the luxurious life of summer, even the most careless among us give pleased attention to the birds that bravely endure with us the rigors of winter. And when this winged companion of winter proves to be the most fascinating little ball of feathers ever created, constantly overflowing with cheerful song, our pleased attention changes to active delight. Thus it is that in all the lands of snowy winters the chickadee is a loved comrade of the country wayfarer; that happy song, "chick-a-dee-dee-dee," finds its way to the dullest consciousness and the most callous heart.

One day in February we were, with much enjoyment, wading through a drifted highway that skirted a forest, the least twig of which bore a burden of soft snow. Over all hung that silence of winter which is the most "silent silence" that rests upon the earth anywhere outside the desert. No breeze swayed a creaking branch or shook from it the snow in soft thud to the white carpet below. Even the song of the brook was smoth-

ered beneath coverlets of ice and pillows of drift. We stood fast, awed by the stillness, when suddenly it was broken by the thrilling notes of the chickadees. We could hardly credit our senses, for it seemed as if the woods was a hopeless place for any living creature that morning. But there before our eyes was a flock of these courageous birds hunting for food on the leeward sides of boles and branches left bare and black in the recent storm. Their tiny weights sent the snow in showers from the terminal twigs, which phenomenon was greeted with triumphant song while the cheerful midgets hunted the relieved branches topside and bottomside for any lurking tidbit. As we watched them, Emerson's poem came to mind:

> "Piped a tiny voice near by,
> Gay and polite, a cheerful cry—
> Chick-chickadeedee! saucy note
> Out of sound heart and merry throat,
> As if it said, 'Good-day, Good Sir!
> Fine afternoon, old passenger!
> Happy to meet you in these places
> Where January brings few faces.' "

No wonder that the great American philosopher was attracted by this other American philosopher who sings when he is cold and hungry.

Besides its usual song the chickadee has a song that says "phoebe" much more distinctly than does the song of the phoebe itself. Few people recognize this, and often in February or early March it is announced in the local newspaper, "The phoebe-birds were heard to-day" though it may be weeks yet before these birds arrive. The two songs may be easily distinguished by even the ear untrained to music. In the phoebe song of the chickadee, the last syllable is at least one note lower than the first and has a falling inflection; while the last syllable of the phoebe bird's song is at least a half note higher than the first and has a rising inflection.

Not long since I visited a the deserted nest of a devoted pair of chickadees. It was cuddled down in the bottom of a hole that opened on the very top of a fence post, and, one would imagine, must have been wet more than once when inhabited. However, a large family was raised there during the past season and much enjoyment was derived from watching the many fubsy birdlings that found home and comfort in that

A chickadee at a suet restaurant

Photo by R. B. Fischer

unattractive retreat. I looked upon them with special interest, for I was sure they would visit the suet on my trees this winter and thus become friendly neighbors.

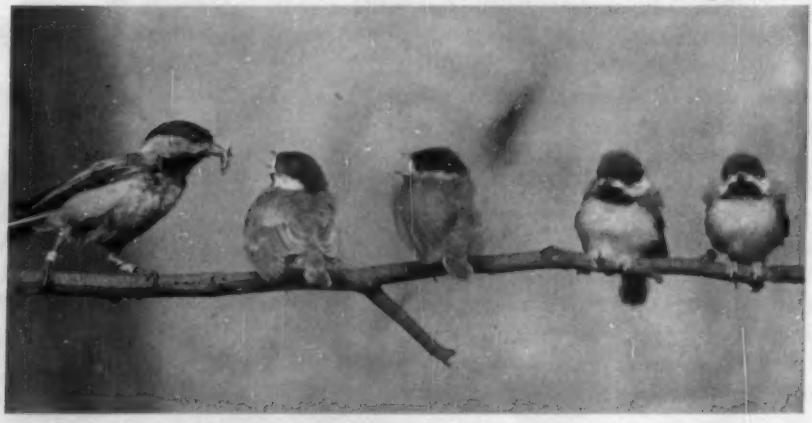
As soon as the trees are bare, nail or tie bits of suet to branches which may be observed from your windows. I know of no investment which pays such enormous dividends both to pleasure and pocket as do suet restaurants in orchards patronized by chickadees. Every child, at home or school, will be attracted by this experiment.

Questions on the Chickadee

1. Describe the colors of the chickadee above; below; wings; tail; throat and head.
2. Describe the differences in coloring between the chickadee and the nuthatch.
3. What is the shape of the chickadee's beak and for what is it adapted?
4. Does it frequent the trunks of trees, or the twigs?
5. Describe its actions when hunting for food on a twig.
6. What is the chief food of the chickadee?
7. Why is it of special value to the farmer?
8. What are the differences in the winter and summer habits of the chickadee?
9. Do you know the "phoebe" note of the chickadee?
10. Where do these birds build their nests and of what material?
11. What are the colors and markings of the eggs?
12. When is the nesting season?

A chickadee family

Photo by A. A. Allen



Spring Studies

I. Alice Gertrude McCloskey

As a teacher in Saratoga Springs, her birthplace, Alice McCloskey (1868 to 1915) became interested in putting into practice the "new" Cornell nature-study work. She did it so successfully that "Uncle John" Spencer, who observed her teaching, asked to have her brought to Cornell to help in the Junior Naturalist work. From 1899 to 1907 she served in that capacity, contributing chiefly as editor of the *Junior Naturalist Monthly*. During this period she completed studies for the degree of Bachelor of Arts from Cornell University.

Miss McCloskey was not a trained naturalist, but she saw the educational possibilities of nature-study, and was able to use technical matter prepared for her by specialists to achieve educational purposes.

Among comments on Miss McCloskey and her work by Edward M. Tuttle, in the *Cornell Rural School Leaflets* for September 1923 and Fall 1948, are these: "Miss McCloskey was a true educator. . . . Her contact with the rural schools of New York State was extraordinary and far reaching. By printed, written, and spoken word her message spread. *The Cornell Rural School Leaflet* was her creation, and its first eight volumes bear the stamp of her clear vision, sound judgment, and inspiring teaching. . . . Practical suggestions for the work in hand she gave in plenty; but greater by far was her emphasis on character building and on the development of a background of appreciation for the best in literature, in art, in music, in nature; and in the comradeship of friends. . . . Miss McCloskey was an unforgettable person. Even those persons who heard her speak only at some meeting always remembered. On those whose lives touched hers more closely she left an indelible impression. . . . So warm and understanding was her sympathy that young and old eagerly sought her friendship and advice."

CORNELL
Rural School Leaflet
[FOR BOYS AND GIRLS]

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ALICE G. McCLOSKEY and EDWARD M. TUTTLE, Editors

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Vol. 6 ITHACA, N. Y., MARCH, 1913 No. 5

A Chat With Boys and Girls

By Alice G. McCloskey

It is good for every one to think of country places and to hear about them. It is better still to live in them; for when we are near to open fields or dim forests where there are bird songs or music-filled brooks or the sound of singing winds, the world always seems more wonderful.

Not many miles from the College of Agriculture there is a farm that seems to me the best place in the world for boys and girls. It is a fruit farm and you should see the apple harvest—more kinds of apples than you could learn the names of in a long time; there are peaches, too, and juicy, luscious pears, and indeed many kinds of fruit that I cannot take the time to mention.

I want to tell you about the house on this farm; it is so good to look at and to live in. It is built of native limestone and some boulders. Wise men tell us that the boulders reveal a story of a time long, long ago when this part of the country was covered by glaciers. Have you ever thought that you would like to study about land forms and know something of the hills and the valleys and the strange rocks on your farm?

But to go back to the house that I am telling you about. If you look closely at the gray rocks that form the main outside walls, you can find in them many interesting fossil forms of animals that once lived in and by the sea. How do you suppose these forms came to be in this part of New York State? Some of you have heard of fossils. What can you find out in some good reference book about them? Did you ever find one on your own farm and would you like to know something about it? If so, send it to us and we will share with you the interesting story that it may be able to tell.

Inside the gray stone house there is a large fireplace. Isn't a fireplace

one of the best things in the world? You and Fido and the gray kitten all like one. If you ever build a house, remember to have a fireplace. You will then be glad if some one has taken care of the woodlot so that there will be a splendid yule log to burn every Christmas. By the way, look at the woodlots in your neighborhood. Do you think there will be tall trees in them when you grow up?

I wish I had time to tell you about the creeks and all the brooks and rills on the farm that I love. They make such good comrades for boys and girls and, indeed, for older folk. There are many of them on this farm, which go merrily on to a lake that is sometimes peaceful, sometimes playful, sometimes rough, sometimes dangerous. The brooks run on day by day, and once in a while restless little feet wade in them, the while curious young minds find out some mysterious things that the busy world knows nothing about. Who is willing to live where there is not a brook to ripple gaily along in the sweet spring weather?

And I nearly forgot to tell you about the great rocky cliff within stone's throw of the gray house. This is the most wonderful place of all. Trees grow on it and about it, and as you sit on the upper edge of it you are among tree-tops and many a shy bird comes close to you, in no way suspicious of your very quiet self. Four or five feet below you on the side of the cliff a phoebe's nest can be seen. What a safe place some little birds choose! Neither you nor I would dare to climb up to it and no one

The house in the country

could climb down to it, so there the small home stands, in safety on a ledge of the rock-bound height. No wonder that phoebe call in early morning is full of energy and confidence—his home is all right and the rest will come. You must hear a phoebe this spring. Do not mistake the chickadee's plaintive, high "phoebe" call for that of the real phoebe, whose notes are harsher and lower, more decided and more contented. The phoebe looks much like the pewee, but he has a little trick of pumping his tail up and down when on a telephone wire or a twig, which distinguishes him at once. How the phoebes that I have watched many a day seem a part of the rocky ledge and the still gorge that are near the gray stone house!

Let us imagine that we are all together and about to go into the home-like dwelling that seems to welcome us as we enter. We can sit about the fireplace while we talk of the oncoming spring and all that you will do when the wonder days are really here. Some of the more important things to consider are as follows:

Color—The changes of color in the landscape—how the hills become more distinct—how the trees show life in every tender twig full of rich color.

Sounds—Who will hear new notes in the outdoor voices, the chickadee and the sparrow and the rest? Soon the little tree-frog will send its shrill call from the marshes, the crow will caw with spirit, the first robin will sing from the tree, spring will be here. We have loved the winter and have grown strong through its vigorous companionship. We know well its still, white fields, with occasional song of wind and pine and a rare bird note, but the sounds of spring are, perhaps, more welcome.

The burst of spring—Indeed, the spring may seem to come all at once and there will be so much to do: we shall follow the merry, boisterous winds or the gentle ones; we shall listen to the woodpecker tapping away in the woodlot; we shall smell the new-plowed field; we shall follow the brook and watch the rain and look on while the green things grow. . . .

* * *

(*Thoughts on Education* by Alice Gertrude McCloskey)

A little child is always a sacred charge, and there is no greater opportunity than to direct a young mind toward wholesome growth and a realization of the abundance of life.

A school should be a place where children are glad to come, and when the time comes they are sorry to go, but they go knowing they have learned something.

An intelligent observation of nature stays by one, and there is always a desire to pass the knowledge on to someone else.

II. Edward Mowbray Tuttle

In the *Cornell Rural School Leaflet* for Boys and Girls, dated November-December 1911 is the following announcement by Miss McCloskey: "This year your letters (to the College) will be written to the young man who sends a letter to you in this Leaflet. If you should come to know him, as you may some day, you will find that he cares very much for the outdoor world and for all that country life gives. He may not be able to answer all letters personally, but whenever a Leaflet for boys and girls is sent out you will find in it his letter to you . . ." The "young man" was Edward M. Tuttle (1889 to –), born in New York City, and a 1911 graduate of Cornell University.

The following year, 1912, Mr. Tuttle became co-editor of the *Cornell Rural School Leaflet*. After Miss McCloskey's death in 1915 he assumed responsibility for the publication until he resigned, in October 1918, to enter the armed forces. During his editorship, Mr. Tuttle sought to carry forward Miss McCloskey's ideas, and, in Mrs. Comstock's words *(Cornell Rural School Leaflet,* September 1923), "gave to the publication the quality of chaste and beautiful English that was a matter of pride to us all."

The paragraphs reprinted on pages 25, 40, and 41 were taken from Mr. Tuttle's letters to boys and girls, which were often long, and included specific suggestions and directions for activities related to projects presented in the more technical articles in the Leaflets. Frequently they told of walking trips through country areas and of visits to schools, activities which Mr. Tuttle emphasized and enjoyed.

Mr. Tuttle's later life has been given over largely to editorship of educational publications and, as the first executive secretary of the National School Boards Association, to the improvement of American education.

• • •

Our problem in education is to help the world to better things. This depends on the highest development of the resources of mankind–the individual potentialities–and then on the harmonizing of these attainments into unity of purpose–the purpose being service for the good of all.
–Edward M. Tuttle, Cornell Rural School Leaflet, September 1923.

Letters to Girls and Boys

By Edward M. Tuttle

(From *Cornell Rural School Leaflet* Volume 7, Number 4, March 1914)

Dear Girls and Boys:

March days are come, and April showers are on the way. What a sturdy month is March! It marks the great change from winter to spring. It brings boisterous winds that sweep the earth and make the air fresh and sweet. Ice breaks up, the ground begins to settle, and from the top of yonder tree a robin pours forth his cheery song. April follows, and with its warming rains washes away all traces of the winter's rigor. In forest, field, and meadow, in orchard, pasture, and dooryard, the plant world begins to stir and to send forth its brightness.

Gradually everything is changing; day by day buds are bursting into leaves and blossoms; grasses are sending up thin, green, tender shoots; flowers are opening to the sky. It has always seemed wonderful to me that some of the daintiest and the most fragrant flowers should come forth so early in the year when late snowfalls may be on the way; but after the cold white covering vanishes, the flowers are apparently none the worse off. Do we not all love hepaticas, anemones, spring beauties, and the sweet arbutus? In our dooryards, too, tiny snowdrops peep through first and then crocuses, daffodils, and tulips, followed soon by all the wealth of the late spring and summer bloom.

Springtime is growing time. It should be growing time for folk as well as for flowers. With it comes the desire to sow seeds that will ripen for a harvest. There are many kinds of seeds, and girls and boys can help to sow them.

First, there are the true seeds—the garden seeds that you obtain from the seedsman. In this leaflet, there is an article that I hope you will read carefully. We have tried to make it simple and direct, and we shall be glad to hear that it has helped you to have a garden this summer that is truly worth while. . . .

There are other kinds of seeds that you can sow. They are imaginary seeds, but they grow and produce a harvest just as surely as do the real seeds. For example, there are the seeds of industry. . . .

In spring, birds come north again, animals and insects once more abound, and trees, flowers, and weeds begin to grow. All Nature is alive, and there is a fine opportunity to study outdoor life. I hope that all the girls and boys who read this letter will sow seeds of observation, seeds of interest, and seeds of sympathy as they roam the fields and woods and pastures. . . .

I could tell you of many other seeds that are good to sow: the seed of healthfulness, which makes the body strong in order that the mind can develop; the seed of helpfulness, which gives happiness to those who help others; the seed of cheerfulness, which brings smiles instead of frowns, and pleasant words instead of irritable ones; the seed of joyousness, which helps one over the hard places and makes it possible always to see the bright side of things, and which brings song and laughter and merry sport.

Not all seeds are good seeds. As in our garden we must not neglect the weeds, so with these imaginary seeds we must try not to sow weeds and must root them out quickly if they begin to sprout. Weed seeds are those of idleness, selfishness, jealousy, peevishness, disrespect, ill manners, and a host of others. Like real weeds they start quickly, grow rapidly, and require constant watchfulness. . . .

Spring Has Come

(From *Cornell Rural School Leaflet,* Volume 10, Number 4, March 1917)

You do not need to be reminded in print that spring has come. Every moment you are reminded of it first-hand. It comes to you in sound, in odor, in sight, in feeling. Bird song and the call of peepers, wild flowers and the smell of freshly turned earth, bursting buds and the new green on the fields, the balmy air and the soft rain—all these and many others tell you it is spring. Would it not be interesting some time to keep a "signs of spring" calendar? It has been done by some of you. The number of signs you will find is astonishing.

Trained Senses

(From *Cornell Rural School Leaflet,* Volume 7, Number 2, January 1914)

Sometimes I wonder whether, when we travel through the country, we truly see and hear and smell. Are our senses keen and trained? One day I took a walk with some school children. We went along a meadow path and passed a golden buttercup. Afterward I asked, "Who saw a flower blooming?" No one had seen it. All had eyes, but had not used them. On another day, two children and I were walking side by side along a country road; we halted for a moment so as to listen to the sounds about us. A running brook, a cricket, an unseen wagon on a distant road, and, far away, the lowing of a cow were heard. The children had heard the stream, but nothing more that they remembered; yet, when we talked about it, they recalled the other sounds, which they had heard without being aware of them. When we listen, let us truly listen. The world of Nature is full of beautiful sights, pleasant sounds, and sweet odors for him who seeks them.

Spring Peepers

(From *Spring Marshes and Amphibians,* Cornell Rural School Leaflet, March 1933, *The Marsh in Spring)*

Every one who has been near marshes in spring has heard the call of peepers. If you should ride blindfolded through the country in spring, you could tell by the noise of these little frogs whenever you came near a marsh. In each school where this Leaflet is read, some boy or girl should be interested enough to catch one of these little frogs and bring it in for the others to see. Although peeper calls may be heard a mile away the peeper is only about an inch in length. Let one of these little fellows perch himself on your hand. Notice the little pads on the fingers and toes with which he is able to cling to your finger or to grass blades and tree twigs. Try the experiment of taking one from a darkened box and placing him in bright light over a brown leaf. Let your watch tell you how long it takes him to change color.

Look under the chin of your froglet and note whether you have a brown-chinned male or the lighter-throated female. If you have a female do not expect any chorus or song because you will get none. All the calls which you hear come from the males.

If you have been interested in peepers, you may have heard an occasional call during mild weather throughout the winter. In fact, few, if any, months pass in which some calls may not be heard. But just as "one swallow does not make a summer," so one peeper does not make a spring. The fact that a peeper may be calling does not mean that it is ready to migrate to a pond to find a mate. The average date of first appearance of peepers in the vicinity of Ithaca, from 1901 to 1932, has been as late as March 29. The earliest record is that of March 11, 1925, and the latest first appearance was April 14, 1916. The average temperature of the days of first appearance is 57 degrees F. following two days in each of which the average temperature was 49 degrees. . . .

After the peepers arrive at the ponds, the pairs mate and eggs are laid. The eggs are minute spheres of jelly placed rather deep under water, attached to plant stems and refuse. A female may spend several hours laying her eggs and may lay as many as one every five seconds, for some

time, when conditions are favorable. She may lay as many as 1000 eggs, though usually not so many as this.

Under normal conditions, the eggs may hatch in from five to fifteen days, depending upon the temperature. While the eggs hatch, the parent frogs are leaving the ponds and making their way back to the brushland and woodland where they spend the rest of the year. In May and June they are still about the ponds; but as the summer progresses they seem to wander farther and farther afield. Apparently the older and larger peepers take to the trees before their younger relatives. . . .

While the adult frogs make their way to the tree tops, the tadpoles shift for themselves in the ponds. They are practically helpless at first and make excellent meals for many sorts of animals, such as young turtles, shore birds, and water beetles. The tadpoles feed principally on pond scums, and grow rapidly. About the end of June they are ready to leave the water and take up their lives on land with their parents. . . .

Peepers destroy insects; yet most persons will be thankful that these little animals live near, not because of the insects they destroy nor because of their interesting migration and life history, but because the peeper represents the spirit of spring. The first night when we go to sleep with their full chorus in our ears we are apt to have a smile on our lips and to dream of the kindly months that are to follow. Not all of us have the ability to put that appreciation into words so successfully as did Eleanor Johnson, who wrote:

"Somewhere in the woods I heard hyla song,
Piping clear and sweet and thin . . ."

The Spring Peeper, Hyla crucifer, has a dark cross-shaped marking on its back

Photo by R. B. Fischer

Summer Studies

I. Mary Rogers Miller

Mary Farrand Rogers graduated from Cornell in 1896, the year in which the University received the first appropriation to carry nature-study into the rural schools of the State. She was, in Mrs. Comstock's words (*Cornell Rural School Leaflet*, September 1923), "an able student, especially excellent in the biological sciences." She had a farm background—she was born and grew up on an Iowa farm—so "she was naturally drawn into" the nature-study work. She wrote several of the early Teacher's Leaflets. She was lecturer in nature-study extension from 1897 to 1902, and instructor in the University's first large summer schools in 1899 and 1900. Her "outstanding quality," commented Mrs. Comstock, "was excellence and thoroughness as a teacher; this characterized her lecture work as well as the leaflets she wrote."

In 1899, with the encouragement of Professor Bailey, she began the Home Nature-Study Course (page 6). Also in 1899, she was married to William Tyler Miller, who was then working with Professor Bailey. Her work at Cornell ended in 1903 when her husband's editorship of *Country Life in America* necessitated their leaving Ithaca. For a short time responsibility for the Home Nature-Study Course then fell to her sister, Julia Ellen Rogers, who had received a master's degree at Cornell in 1902, and had, during her period of study at the University, been drawn, too, into the work in nature-study.

Mrs. Miller's delightful *Brook Book* was published in 1901; her *Outdoor Work for Boys and Girls* some years later. She continued to write on nature subjects after going West to the University of Illinois and later to California, helping for many years to promote interest in the work to which she had so ably contributed at Cornell.

JUNE—1902

Home Nature-Study Course

ISSUED MONTHLY FROM OCTOBER TO JUNE BY THE COLLEGE OF AGRICULTURE OF CORNELL UNIVERSITY, UNDER CHAPTER 430 OF THE LAWS OF 1899, I. P. ROBERTS, DIRECTOR.

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EDITED BY MARY ROGERS MILLER

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Fence-Row Studies

By Mary Rogers Miller

Editor's Note. A letter of July 31, 1956, from Mrs. Miller told of her present home, "built well after her eightieth birthday," in San Pedro palisades, where she has "a panoramic view of the Pacific" from her wide windows. Her sister, Julia Ellen Rogers, now 90, lives in nearby Long Beach. Miss Rogers contributed a dozen or more books to the body of nature literature, the most notable being *The Shell Book*, now in a new edition, and *The Tree Book*.

* * *

Go ye out into the highways and hedges, not for the sake of those you will find there, but for your own sake. There you will find rest. There, too, you will find intellectual occupation without which rest may become mere idleness.

Is there any neighborhood so thoroughly "civilized" that no fence-row or roadside tangle can be found within easy reach? I hope not. It is such a life-scene that I invite you to visit often during the summer. If a stream flows under your fence, so much the better. If a tall hickory or maple gives you shade from the midday sun, be grateful. But for the fence-row the tree might long ago have fallen under the axe, or perished in infancy at the stroke of the scythe. If a clump of tall sumachs fills a corner with almost tropical foliage, give the credit to the fence. Driven out of the open fields by the plow and the reaper, all the wild things take refuge in the fence-rows. From this stronghold they make incursions upon their old domain, taking toll of the farmer's crop if they be squirrels or mice, or scattering their winged seeds over the cleared land if they be plants. Whether the fence be of boards, stones, rails, stumps or even wire, it is sure to be inhabited.

It is to such a tangle of growing things that the nature student goes

Photo by R. B. Fischer

Teasels or gypsy combs

when, "'long about knee-deep in June" he feels the impulse to get away from conventionalities. The first visit may bring little but the rest and change of scene so eagerly sought by the weary. But every inhabitant of the fence-row unconsciously invites a second visit. Without knowing it you open your mind, and the "teacher" is lost in the student.

If plants appeal most strongly to you there could be no more fascinating theme for summer study than the wild flowers of a fence-row. From June until October there is a continuous procession of blossoms. Dainty sweet brier, pale clematis, fragrant grape, thistles, thimbleberry, wild carrot with flowers like lace, goldenrods, asters and even gentians; they are all there and thousands more. The season closes with the pale golden blossoms of the witch hazel, commonest of shrubs in some neighborhoods, but never commonplace.

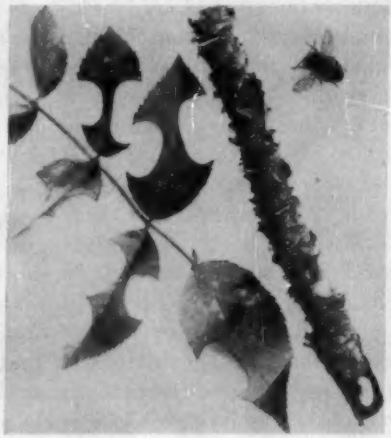
In many parts of this state, along roadsides and in waste places, grow the teasels or gypsy combs. No wonder the wandering bands of gypsies we see now and then look unkempt, if they have no better instrument than the teasel heads with which to comb their dark locks! Every summer I visit the teasels along a certain fence-row and I invite you all to go along with me. They wait until the height of the summer before opening their precious flowers. So we must go in July, and by looking well at many of the plants we shall be able to form an idea of the various stages of development the flower-head goes through. The teasel plant is thought by some people to be coarse and unlovely. To be sure it is rather bristly. Self-respecting cows pass it by, having no doubt tested it with unpleasant results. Some of the plants reach a height of six feet, and with their upward-curving branches, each bearing an oval head, look like tall candelabra. The leaves are long and lance-shaped and well provided with prickles. . . . The teasel plant looks somewhat like a thistle. Its flowers are purple or lilac and borne in a close head. Each flower is attended by a sharp bayonet-like point. The heads are hedged about by long stiff prongs which curve from the base almost to the top.

When the flower-head is very young we can see, between the brown bayonets, the buds faintly tinted with lilac and just ready to push forth. The first flowers that come out form a band of soft purple around the head, about midway between the base and the tuft of tall bristles which adorn the top. The first flowers fade, the petals shrivel or drop away. The seeds are now forming behind the band of brown prickles. Two more zones of flowers follow the first; one above and one below. Finally, at the very top among the tuft of bristles, and at the base a few straggling blossoms come out, inviting the bees which probably pay more attention to the showier bands than to these last stray blossoms. Each teasel head passes through all these stages.

Studiously as one may set about to neglect all else but some one chosen subject, it soon becomes difficult to carry out the intention. How, for example, in studying the rose bushes of garden or fence-row can one ignore the "leaf-cutter bee?" She uses her tiny shears neatly, cutting out a circle here, an oval there—as if she had laid on a pattern each time and traced it with care. When we see leaves cut like this, we may be as certain who has done it as if a printed card had been left by the bee. Who can help wondering what the pieces are cut out for and how they are used? Are they carried away for food? If so, why should the creature's appetite be "round to-day and oval to-morrow?" Or are they used for nest-making, not for food? Then who will find a nest—a slender tunnel in soft decaying wood, divided into cells or "stories" upholstered with many of the oval or dumb-bell shaped pieces of rose leaves? Between each two cells is a partition made of the circular pieces. In this tidy apartment-house live the family of the thrifty little mother, helpless but well provided for. In each cell when the nest is found in midsummer is a small grub, eating its way into a soft mass of pollen and honey, garnered by the same little leaf-cutter. The mother plays the part of provider as well as architect. You may even be fortunate to see the bee visit the rose bushes and cut out the pieces. With what skill she works, and with what almost incredible swiftness! Watch for her.

A leaf-cutter bee, a tube of its cells, and a cut rose-leaf

From Department of Entomology



My Dear Friend:—

This is your vacation lesson. I wish I could bring you together in groups of a dozen or more and take you for "field trips" along a brook, through woodland paths or across a pasture. Since such a plan is not feasible, at least for this summer, will you not take the trips with other friends? Perhaps some child with wide open eyes and mind, will show you where the meadowlark has hidden her speckled eggs in a hummock of grass, or where a family of wasps has hung the paper "castle in the air" in some tall tree.

Photo by Verne Morton

The witchhazel shows its dainty yellow flowers in October

Your experiences through the summer will afford you a fund from which to draw when lessons are to be presented next winter. Hoard every bit of fresh nature-knowledge you gain. You will not be long in accumulating such a store as will enable you to discriminate between such books about nature as are true to life and those which are unworthy your time or the children's.

Our next lesson will reach you in October just when the witchhazel is beginning to take on a tinge of yellow, and perhaps to open its miniature bombardment of shiny black seeds. Whether you are able to study the exact things suggested in this Quiz or some others makes little odds. It is important that you add daily to your nature knowledge some new bit of truth.

Yours for a happy vacation,

MARY ROGERS MILLER

Editor's Note. A 4-page quiz accompanied this leaflet. It contained questions to be answered by observation and "should be returned in September." The questions in these quizzes were "for the purpose of bringing out some facts in the student's own experience." Reports were regularly due "within eight weeks after the receipt of the lesson."

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VOL. V. CORNELL UNIVERSITY, ITHACA, N. Y. NO. 10

II. John Walton Spencer

Uncle John's Talk About Weeds With the Junior Gardeners

My dear Boys and Girls:

Billy Boy and I have been pulling the weeds. There were a lot of them and they were big ones, and in your Uncle John's garden at that. Perhaps you think that my garden should be a model for you to copy. It may be a model for a small part of the time, but not all the time.

The weeds of which I speak grew in a corner of the garden where I had sown flower seeds that did not come up. While I was protecting the plants that did come up, the weeds in this corner grew unmolested. The way they grew put me in mind of Jack's bean stalk.

There were more questions in Billy's head than you can find weeds in a corn field. He wanted to know why the flower seeds did not come up. I explained that there may have been several reasons. Perhaps the seed was poor and would not have grown under the most favorable conditions. I was certain that if the seeds were well ripened and not too old they would have grown if they had had a fair chance. Perhaps the seeds started to grow and while the sprouts were reaching down into the soil for moisture and food, the dry weather withered them and they died of thirst, like a man lost on a desert. Then he asked me how, if the conditions were unfavorable for flower seed, I could explain why the seeds of the weeds could grow, for weed seeds have no friends to care for them. This seemed a difficult question and I thought best to answer it by telling him that all plants are not alike in endurance, any more than are boys. I told him that there are strong and robust plants, as there are boys that can endure great hardship. The weeds are used to our soil and climate; perhaps the flowers are not.

The seeds of some weeds can remain deep in the soil, without harm, sometimes for a number of seasons, awaiting the time when the spade and rake may bring them near the surface where they can grow. I know

of some puny boys who are the constant care of anxious mothers. They must be bundled up lest they take cold or otherwise be sick. If weed seeds were of the puny kind, the gardens and fields would soon be rid of them, for they have no mothers to coddle them.

After this explanation Billy was quiet for a time, and then he began asking questions again.

"These weeds are not all of the same kind. Do you know that?" he asked.

"Yes, I know they are not. How do you suppose they all got here?"

"Are they all American weeds and were they found here like the Indians?"

"No, I think that but few of them are natives. Most of them are foreigners," I replied.

"How did the first seeds come across the ocean?"

"In ships, as people do. Probably only a few of them came at a time. By some means they got a foothold near a seaport town and then by various agencies were scattered over the country. Seeds are great travelers. Or some of them may have been carried at once far inland with grain or other seeds."

"Yes," said Billy, "I know that seeds travel, for I know the dandelion and thistle-down and those things. How many kinds of weeds are there, Uncle John?"

"I do not know, Billy. I never counted them all. I cannot tell any more than I can tell how many people I have met in a day or a week. Let me tell you how you may get some 'fun' out of this dull work. Take a sample of every different weed you find and lay it out on the grass and when we are through pulling we will count them."

"Say, Uncle John, we will run a race to see who will find the most kinds."

From this time to the finish, my young friend pulled weeds with about the same ardor that he would play ball, with perhaps less shouting. He beat his old Uncle in the number of kinds found, by two or three. He said this was because he worked harder and pulled more weeds and therefore found more new ones. But I was pleased especially that Billy had learned that weeds are plants, just as his flowers are, and that they all have interesting ways.

All this aroused Billy's spirit for making a collection—a desire that most youngsters have. He has since been searching the country over for weeds common and uncommon. He has dried them between the leaves of books and will soon paste them on sheets of white paper. He has named all of which he was certain of the correct name. The others he will send to the Bureau of Nature-Study where persons will be glad to help him to

the correct names. He intends exhibiting these weeds at the County Fair. He will be able to show many weeds that people have seen all their lives but which they have never taken the trouble to learn by name. Billy does not know it, but it is a fact that the mere name will not be of much consequence, but the plant and the name together will open persons' eyes and acquaint them with the weeds and other plants. It will set them to thinking.

I have told you that my patch of weeds was of lusty growth. The weeds covered the ground completely and I stepped into them as I would into a patch of grass that reached to my knees; which means nearly to Billy's hips. After we had worked for a while, Billy lay on the ground to rest and looked in among the weed stalks as he would into a miniature forest. Beneath the shade of the larger weeds he saw some weak and spindling ones. He called my attention to the fact and said the larger weeds were domineering over the smaller ones as big boys sometimes impose on the little boys. I said in reply that such was true. When the weeds first came through the soil all were of nearly the same size. As they grew larger and larger, they began to crowd. By some chance, here and there a weed got some little advantage and grew a little taller than the others and overshadowed them and kept them from the sunlight. The same thing will always occur when there are more weeds than opportunities. The same is likely to happen with all living things, the strong tending to become stronger. That is what grown-ups call the "struggle for existence"—an expression that Billy Boy will often hear as he grows older; but nowhere will he see a better illustration than we found in that bed of weeds. Billy has a strong sense of justice and he proposed that we pull out the domineering weeds and let the underlings have a chance. I could not consent to that as I wanted the ground for some late asters. If we did as Billy wished, it would not be long before these weak weeds would become prosperous and domineer over my asters, as other weeds had once domineered over them.

Clearly, Billy had become interested in weeds as well as in the flowers that he had planted. He asked, "What is a weed, anyway?"

"A weed, my boy, is a plant that gets in our way or gives us inconvenience. Professor Bailey says it is a plant that is not wanted."

I told him that a plant that is a weed in my garden might not be a weed in his garden. A corn stalk is a weed in my bed of asters, but asters might be weeds in his corn. But there are some kinds of plants that nobody seems to want, and these are the real weeds.

How are you getting on with your garden? Just now I have some gladiolus that are my pride and joy. I am thinking that another spring I shall recommend them for children's gardens. I think that five cents will

buy five bulbs. The money can be secured by forming clubs. If planted in any reasonably good soil, there is no trouble about their coming up, as is often the case with seeds. If the robber weeds are kept down, you will have gorgeous blossoms. When the time comes in the fall to take up bulbs, the five bulbs you planted may have increased in number.

I hope you will have some flowers to take to the County Fair. . . .

Cordially your Uncle,

JOHN W. SPENCER

Meet the Wasps!

(Excerpts from an undated circular letter)

My Dear Boys and Girls:

When summer comes I wish you would become intimately acquainted with the wasps. I know that some people are afraid of them and have trouble with them. As a rule this is unnecessary. If people will quietly mind their own business the wasps will mind theirs. I admit having been stung when I had no thought of harming them. That was due to the fact that they misunderstood my motives. . . . If you go flailing the air with bushes and things trying to drive them away, they will strike back and there will be a hot spot wherever they may hit. They seldom sting cattle or horses and they will not sting you if you approach them quietly. At my farm home last summer, I formed an intimate acquaintance with several families of wasps. Each family had its particular way of preparing a home and "bringing up" the youngsters. After the day's work was done and supper eaten, I occupied a hammock on the back porch and there watched them coming in and going out of their homes about sunset time. . . . During the middle of the day I met the same fellows out in my vineyard and fruit orchards. . . . I know a very wealthy man who rides to his office at 10 o'clock each morning in an automobile. People call him Mr. Midas. A number of years ago he went to his work with a dinner pail in his hand at 6:30 each morning. Then people called him Jake. He would be called Jake yet only he had an interest in a patent for making paper out of wood. The wasps made paper from wood with which they built themselves castles before Columbus discovered America. In some parts of the state I have Junior Naturalists who are very familiar with this industry. Near them are great mills which consume piles of wood as large as small mountains. The product is called pulp and from the pulp paper is made. People speak of the process as a recent discovery. The wasps know better.

From 1919 to 1952

EPHRAIM LAURENCE PALMER

In the fall of 1919, E. Laurence Palmer returned to Cornell, his alma mater, to begin a 33-year period of service in the College of Agriculture. During that time 130 Cornell Rural School Leaflets were issued under his supervision. Most of them were Professor Palmer's work, and all of them reflected his philosophy. Teaching, writing, speaking to innumerable groups, and maintaining a weekly radio program for 27 years were other avenues through which he contributed to nature and conservation education, both at Cornell and on a nationwide and international basis. Through his students and his own travel, his sphere of influence was further extended. He has taken an active and constructive part in many professional organizations. Since 1950 he has been director of conservation education of the National Wildlife Federation.

Dr. Palmer (1888 to —) was born in McGraw, New York, and received his early education in the Cortland public schools. After graduation from the Cortland Normal School, now the State University Teachers College at Cortland, he entered Cornell University, where he received a bachelor's degree in 1911. From 1910 to 1913, he served as Assistant in Botany in Cornell University. The years between 1911 and 1919 were occupied with graduate work (M.A., 1913; Ph.D., 1917), with teaching botany and elementary agriculture at Iowa State Teachers College in Cedar Falls, and with service in the United States Navy.

Dr. Palmer retired from active service at Cornell in July 1952. He has continued his two chief interests, writing in the field of natural history and promoting effective conservation education. In this latter field he has been recently honored by election as a member of honour of the International Union for Conservation of Nature and Natural Resources.

The Leaflets, 1919 to 1952

THE following brief survey of the Leaflets issued under Dr. Palmer's direction is, for the most part, in his own words (from the Teachers' Number, September 1952, pages 26 to 28).

"The Leaflets have varied in kind throughout the years." Numbers "covering the various fields of science dealt with such systematic groups as mammals, birds, fishes and other coldbloods, insects, invertebrates other than insects, woody plants, herbaceous plants, fungi, ferns and their relatives, and microorganisms. In the earth sciences, they dealt with rocks and minerals, the stars, weather and climate, earth forms, fossils, and earth history. A series of physical-science Leaflets included numbers on heat, light, weight, sound, electricity and magnetism, the chemical nature of matter, the physical nature of matter, and pounding and cutting tools. Leaflets on domestic mammals, domestic birds, cultivated plants, house plants, and garden flowers continued similar work of earlier writers. . . .

"Leaflets concerned with ecological subjects dealt with such places as fields, woodlands, and waterways . . . Eventually this ecological approach led to the . . . 'laboratory' series, which has included *Wet Laboratories, Wooded Laboratories, Lawn Laboratories, Paved-desert Laboratories, Window Laboratories,* and *Outdoor Laboratories.*

"A series on outdoor living has included children's Leaflets on campfires and camp cookery, safety, survival in winter, wild foods, and outdoor living; and teachers' numbers on emergency science in the out-of-doors and on outdoor education."

Leaflets "definitely focussed on conservation" have included "units on saving the soils, on vermin, on cover, on winter food for wildlife, on hedgerows, on wildfire, on fish bait, on fish and fishing, on the management of waterways . . . and *The Story of Conservation in New York State,* prepared by Clayton Seagears, of the New York State Conservation Department. At least four of the annual teachers' numbers have been given wholly to the teaching of conservation."

Several numbers have been "devoted to general topics which frequently involved several fields of science and were concerned with broad understandings." Examples are *How Things Move and Are Moved; Through the Year; New Life; Homes;* and *Over the Ground.*

With so much and such varied material to choose from, the problem of selecting representative bits to reprint was difficult. The following article is offered as an example of Professor Palmer's ability to weave facts into a meaningful, thought-provoking whole; and as an emphasis of his belief that "learning depends in large part at least on sensory experiences with one's own immediate environment."

CORNELL RURAL SCHOOL LEAFLET

VOLUME XXXVIII ITHACA, NEW YORK, SEPTEMBER, 1944 No. 1

Early Steps in Science

By E. Laurence Palmer

THERE has never been and probably never will be a time in history when an understanding of science has progressed uniformly in the different parts of the world. Neither has progress in the various fields of science been uniform. Yet modern leaders in science are dependent to a large extent on what those who have gone before them have done.

Some 4,000 years before the beginning of the Christian era, discoveries were made in Egypt, China, India, or Babylonia that are now being used by most modern peoples. Discoverers of facts, developers of inventions, molders of philosophies, and teachers of the truths and methods of science have all contributed to what we now accept as science. Much of what we now do may be traced with some certainty through preceding generations to the original source of inspiration or instruction. . . .

In the early history of science as a realm of human experience, we recognize as important the three pupil-teacher generations represented by Socrates (B.C. 469-399) who taught his pupil Plato (B.C. 427?-347) who in turn assisted in the training of Aristotle (B.C. 384-322). Plato said: "Whatever we Greeks receive, we improve and perfect," and again, "Now, this is like the Muse who gives first to men inspiration herself, and from those inspired, her sons, a chain of other persons is suspended, who take inspiration from them."

We can present here only a few highlights in the 2-thousand-year history of what we now teach. The Romans took much of their culture from the Greeks, but before the fall of Rome manual labor came to be regarded as degrading. In such an environment, science cannot prosper. In the early centuries of the Christian era, there was a profound conviction that the Judgment Day was near at hand. Much time that might have been spent studying natural phenomena was spent on saving souls. While Western Europe was spending a large part of the ten centuries preparing for a day that never came, the Arabs in the East were developing science. One of their writers in 850 A.D. wrote: "In the last day may Allah have mercy on the soul of Al-Razi, for he was the first of mankind to draw up a table of specific gravities."

After almost a dozen centuries, a revival of scientific investigation

came to Europe. The magnetic compass was discovered and came into use. Travellers were bringing home what they had learned in foreign lands. Marco Polo (circa 1254-1324), coming home from China, told of "a kind of black stones" that "burn like firewood," and of some farm practices he had observed that are only now being accepted in some parts of New York State. Speaking of wildlife conservation by the Great Khan, he said: "Near this city is a valley frequented by great numbers of partridges and quails, for whose food the Great Khan causes millet and other grains suitable to such birds, to be sown along the sides of it every season, and gives strict command that no person shall dare to reap the seed; in order that the birds may not want nourishment."

A general picture of what the students of earth science in these early days thought of the nature of our earth is interesting. In 1688, Hooke (1635-1703) wrote: "Earthquakes have turned plains into mountains and mountains into plains, seas into land and land into seas, made rivers where there were none before and swallowed up others that formerly were." In 1695, John Woodward voiced his belief that "the whole terrestrial globe has been taken to pieces at the flood and the strata settled down from this promiscuous mass." During these years, Gottfried Wilhelm Leibnitz (1646-1716) traced a more or less orderly development of the earth from a disorganized glowing mass to a smooth globe with a cool exterior. About 1790, Abraham Gottlob Werner (1749-1817) defended the idea that the earth solids had been first of all dissolved in the heated waters of the "universal sea" (the Neptunian theory). American scientists played no small part in developing the more rational idea that was accepted later.

To understand something of what has been done in nature study at Cornell, we must recognize Döllinger (1770-1841), a professor of anatomy in Würzburg and Munich, not so much for what he added to the field of science as for what he taught his students, von Baer, Agassiz, von Martius, and others.

Jean Louis Rodolphe Agassiz (1807-1873) spoke at the opening of Cornell University and helped train many of the institution's early scientists. More of his story is told further on in this Leaflet.

When von Baer went to study with Döllinger, he explained that he wished to study comparative anatomy. Döllinger remarked that he did not happen to be lecturing on anatomy that semester and then added, "But why lectures? Bring some animal, any animal, and dissect it here, and after that something else." Starting with a leech that von Baer happened to pick up in an apothecary shop, Döllinger led his student to his life work and to the birth of the science of embryology. In 1827, von Baer

was the first to discover the mammalian egg. Not only did he discover things but he wrote of them so brilliantly that years later T. H. Huxley (1825-1895) wrote Charles Darwin (1809-1882): "Since I read von Baer's essays, nine years ago, no work on natural history science I have met with has made so great an impression on me." Huxley himself wrote so splendidly on the crayfish that most biology courses today use this animal as a typical example of its group. Other Europeans during this period added significant bits to the field we now recognize as science. Linnaeus classified the living things he met. Later, Darwin was to suggest one method by which the varied forms might have developed.

While these early investigators were learning some of the most important secrets of nature, others were doing much, either intentionally or incidentally, to spread these discoveries abroad. Sometimes, as with Gilbert White (1720-1793) at Selborne, England, these efforts consisted of notes on what was seen in a particular time and place. Others, such as Izaak Walton (1593-1683) in *The Compleat Angler,* were presenting homely philosophies about the joys of fishing or other outdoor recreation.

With the growth of America, men of like interests on opposite sides of the ocean came to rely on correspondence for developing their interests. These exchanges of experiences by letters such as those between Peter Collinson and John Bartram helped create a literature basic to much of our present-day science.

While investigators were adding to the sum total of human knowledge and others were putting their views in writing for one purpose or another, still others were concerning themselves with helping children make the best use of their formative years, and were helping to develop a philosophy of education that to no small extent influences what we believe and do today. Many of these educators were Europeans but some, even in the early days of our country, were Americans.

Johann Amos Comenius (1592-1670) is credited with writing the world's first pictorial school book. Obviously, in reviewing the development of a Cornell Nature Study philosophy, such a man cannot be ignored. He wrote: "Since the beginning of knowledge must be with the senses, the beginning of teaching should be made by dealing with actual things. The object must be a real, useful thing, capable of making an impression on the senses. To this end, it must be brought into communication with them; if visible, with the eyes; if audible, with the ears; if tangible, with the touch; if odorous, with the nose; if sapid, with the taste. First the presentation of the thing itself, and the real intuition of it, then the real explanation for the further elucidation of it" . . . He said, "Instruction must begin with actual inspection, not with verbal description of things." He criticized the schools of his time for not showing

children things as they were but telling them "what one and another, and a third and a tenth, has thought and written about them, so that it is considered a mark of great wisdom for a man to know a great many opinions which contradict each other" . . . Would that those who today write elementary-science curricula directed toward the presentation of great generalizations should ponder these ideas of Comenius.

Some years later, in the famous book *Emile*, Jean Jacques Rousseau (1712-1778) described education "according to nature." Advocating that children be kept from the formal schools of the time, Emile's teacher said: "In general never substitute the sign for the thing itself, save when it is impossible to show the thing, for the sign absorbs the attention of the child and makes him forget the thing represented."

When Pestalozzi (1746-1827) tried to use Rousseau's methods on his own child he recognized the weaknesses and particularly pointed out the need of studying children themselves. He rejected the memorization of text material and said, "The most essential point from which I start is this: sense impression of nature is the only true foundation of human instruction because it is the only true foundation of human knowledge. All that follows is the result of this sense impression and the process of abstraction from it. Observation is the absolute basis of all knowledge. The first object then, in education, must be to lead a child to observe with accuracy; the second, to express the result of his observations."

When Pestalozzi was himself but three years old, our American Benjamin Franklin wrote of the study of nature as follows in his *Proposals Relating to the Education of Youth in Pennsylvania:*

"Much of it falls within the Capacity of Persons, even of Children. It consists in attending the objects with which Nature presents us, in considering them with Care, and admiring their different Beauties, etc. Searching out their secret causes indeed more properly belongs to the Learned. I say that even Children are capable of Studying Nature, for they have Eyes, and don't want Curiosity; they ask Questions, and love to be informed; and here we need only awaken and keep up in them the Desire for Learning and Knowing, which is natural to all Mankind. Besides this Study, if it is to be called a Study, instead of being painful and tedious, is pleasant and agreeable; it may be used as a Recreation, and naturally be a Diversion. It is inconceivable, how many Things Children are capable of, if all the Opportunities of Instructing them are laid hold of, with which they themselves supply us. A Garden, a Country, a Plantation, are all so many Books which lie open to them: but they must be taught and accustomed to read in them."

One wonders if those lines of Franklin were ever read by Pestalozzi in

Europe or by Edward Sheldon or Anna Botsford Comstock in America. Surely, they would have struck a responsive chord in all these educators.

Some years after Pestalozzi advanced his philosophy, another European educator, Friedrich Froebel (1782-1852), presented his ideas on kindergartens. It is not without significance that he was a student of and a teacher under Pestalozzi at Yverdon from 1808 to 1810. He added a profound religious tone to much that was advocated by his teacher. He also suggested a practical emphasis (like that in the 4-H Club idea of today) when he said, "Particularly helpful at this period of life is the cultivation of gardens owned by the boys and cultivated for the sake of the produce." He added, "If the boy cannot have the care of a little garden of his own, he should at least have a few plants in boxes or pots, filled not with rare and delicate or double plants, but with common plants that have an abundance of leaves, and thrive easily." No doubt the expressions of this teacher did reach the ears of those who molded the nature study idea in America and at Cornell. As will be seen later, where kindergartens appeared, as in Oswego, Boston, and St. Louis, there also developed other educational practices involving many features that characterized the Cornell nature study idea. When we read of Comenius, Rousseau, Franklin, Pestalozzi, and Froebel, or later, of Sheldon, Agassiz, Harris, and Jackman, we realize that the basic idea originated not in any one institution nor with any one person.

On Science Programs

Briefly, it is the conviction of the writer that a science program should develop an honest, critical, open-minded, impersonal habit and spirit of inquiry which recognizes the relationship between cause and effect and looks to proof for authority rather than to authority for proof. It will encourage the making of adequately accurate observations which may be used to develop the imagination to aid in recognizing significant generalizations.—*E. Laurence Palmer,* Cornell Rural School Leaflet, September 1935.

The Children's Leaflets for 1956–57

The Fall Children's Leaflet, entitled *Fruits of Wood and Fencerow,* will be ready for distribution soon after the school year begins. Tentative titles for the Winter number and the Spring Leaflet are *Electricity and Magnetism,* and *Beetles.*

Over the Years

Eva L. Gordon

Perhaps one could say that through the years since Cornell University undertook "to encourage nature-study in the rural schools," only the underlying purpose of the work has remained unchanged: to help the young people of the state to understand and appreciate the world around them. From its initial objective, "to improve agriculture," has evolved the more general goal of helping children (and older persons, as well) gain the understandings, attitudes, and skills essential to living efficiently and appreciatively in a world of science.

Leaflets and their authors

In tracing the evolution of Cornell nature-study publications through the years, the work of eight persons has been especially stressed. These eight persons not only wrote extensively for the publications with which they were identified, but they were responsible for larger programs of which the leaflets were a part.

Many other authors have contributed to the nature-study leaflets of the past sixty years. Most of these were staff members contemporary with the eight persons whose writings are represented in this Leaflet. Specialists in the various fields of science and in education have contributed generously, both directly and through suggestions and advice. Some students, too, have taken part in Leaflet preparation.

To note the number of these persons, and to read the articles they wrote has brought new awareness of the expert knowledge, the skill in writing, teaching, and illustrating, the interest, and the effort that have gone into these varied publications.

Distribution of the Leaflets

The first Teachers' Leaflets were "sent free to all engaged in teaching in the public schools of the State of New York." The first leaflets for children were distributed free to any resident of the State. In time, restrictions developed, chiefly due to financial limitations. For a time state-wide distribution of teachers' leaflets continued but children's leaflets in quantity went only to schools in communities of 3000 population or less. The population figure for eligibility to receive children's leaflets

changed from time to time and finally teachers' leaflets, too, were distributed on the same population basis.

Now teachers' leaflets are supplied, on request by principals or superintendents, to teachers of grades 1 through 8 and to teachers of science or agriculture, in New York State communities of 4500 population or less, or in centralized schools. Eligible teachers above grade 4 may apply for enough children's leaflets for class use; other teachers may have single copies. With the present trend to consolidation or centralization of school facilities, the question arises whether some new basis of distribution is not indicated. (Leaflets are available to persons not eligible to receive them free at a subscription rate of a dollar a year.)

Lines of Work

In the June 1899 *Nature-Study Bulletin*, three years after state-supported work in nature-study was undertaken by the College of Agriculture, the following synopsis of the work appeared:

> The Nature-study movement proceeds along several lines, of which the following are chief:
>
> (1.) Efforts to reach the children through the teacher, by means of:
> Teacher's leaflets.
> Instruction at teachers' institutes.
> Instruction at State summer schools.
> Instruction in a school of nature-study at Cornell University.
> Home nature-study course.
> Personal correspondence.
>
> (2.) Efforts to reach the children directly, by means of:
> Naturalist clubs.
> Children's leaflets.
> Making of gardens.
> Collecting of insects.
> Holding of flower shows.
> Personal correspondence.

At that time the work in nature-study was organized under a Bureau of Nature-Study, of which Liberty Hyde Bailey was Chief, and John W. Spencer, Deputy Chief.

Through the years Corn Days, various agricultural contests, and ambitious exhibits during Farm and Home Week (established in 1908), were among activities that rose to prominence, and then were put aside.

Present Organization and Activities

The present-day Section on Nature, Science, and Conservation Education in the Department of Rural Education has maintained certain of these earlier activities, has discontinued some, and has added others.

Four numbers of the *Cornell Rural School Leaflet* still go out during

each school year to eligible schools who request them. Of these Leaflets, the first issue of each volume is for teachers; the others are primarily for children's use. Sponsorship of the Leaflet has been a responsibility of the Department of Rural Education since 1913.

Through courses on campus and presented extramurally, and through participation in conferences, workshops, and similar activities, the function of instruction of teachers has been continued. Leadership training through graduate programs has become an increasingly important part of the work; and growing attention is given to the training of prospective teachers of science at all levels.

Personal correspondence, with teachers and with children, less emphasized than in earlier years, still brings to us comments, suggestions, requests, and frequent opportunities to help with special problems--contacts that we enjoy and hope to have continued.

About 30 years ago, Professor Palmer instituted a weekly radio program, *This Week in Nature*, which he maintained for 27 years. Through it many young people, especially children from schools near Ithaca, had an opportunity to "go on the air." After Professor Palmer retired from active service in the College of Agriculture, the program was carried on until early in 1956, when it was discontinued, to provide time for other activities.

Beginning in 1949, direction of an annual Conservation Workshop for Teachers and other school personnel has been a responsibility of the Section. These workshops are held in August, at the Arnot Forest, near Ithaca, and are presented with the cooperation of the staff of the Cornell Department of Conservation, and with the support of the New York State Conservation Council.

The Future?

In presenting a 607-page volume, entitled *Cornell Nature-Study Leaflets*, made up of selections from previously published materials, Liberty Hyde Bailey wrote, in 1904: "In these reprinted leaflets the reader will find many methods of presentation of a great variety of subject-matter. . . . Our own ideas as to what is a valuable leaflet have changed greatly since the work was begun; and it is to be expected that they will continue to change with the progress of the work and the development of the schools."

Changes have been many in the past, not only in the character of the leaflets and the philosophy of those responsible for them, but in the schools—and the times—in which these materials are used. What new developments the future will bring remains to be seen.

References

Teachers' Numbers of the Cornell Rural School Leaflet for September 1923; September 1944; September 1950; and Fall 1952. Only the last-mentioned is available from the Leaflet Office, Stone Hall, Cornell University, Ithaca, New York, but the others may often be found in libraries.

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Cornell Rural School Leaflets, 1920 to 1956

January 1920, Small winter mammals
March 1920, Game fishes
September 1920, Teachers' number
November 1920, Aquatic insects
January 1921, Winter weeds
March 1921, Spring birds
September 1921, Teachers' number
November 1921, Woody plants in autumn
January 1922, The earth and its weather
March 1922, Amphibia and reptilia
September 1922, Teachers' number—including bird-nest key
November 1922, Land insects
January 1923, Winter birds
March 1923, Spring flowers
September 1923, Teachers' number—including a history of nature study
November 1923, Camp fires and camp cookery
January 1924, Woody plants in winter
March 1924, General invertebrates
September 1924, Teachers' number
November 1924, Shore birds and game birds
January 1925, Pests of plants, pets, and people
March 1925, Cultivated plants
September 1925, State parks, New York Indians
November 1925, Larger mammals
January 1926, Rock stories; the fossils
March 1926, Moths and butterflies
September 1926, National parks
November 1926, Woody plant seedlings
January 1927, House plants
March 1927, Domestic birds
September 1927, Non-game fishes
November 1927, Fungi
January 1928, Rocks and minerals
March 1928, How things move and are moved
September 1928, Study outline: New York Indians
November 1928, Flowerless green plants
January 1929, Domestic mammals
March 1929, Spring birds
September 1929, Special-methods aids
November 1929, Through the year
January 1930, The sky at night
March 1930, Flowers of woody plants
September 1930, New York Indians; Poet and Naturalist
November 1930, Fall weeds
January 1931, Earth forms
March 1931, Parental care
September 1931, Study outline; Index, vol. 13, no. 3, to vol. 25, no. 1
November 1931, Fall insects
January 1932, In the woods in winter
March 1932, Garden flowers
September 1932, Study outline; New York State fishes
November 1932, Poisons, diseases, and medicines
January 1933, Light
March 1933, The marsh in spring

September 1933, Humane traps; marionettes
November 1933, Fields in fall
January 1934, Sound
March 1934, New life
September 1934, Elementary-school science
November 1934, Fruits of woody plants
January 1935, Heat
March 1935, Made of earth
September 1935, Elementary-school science
November 1935, Weight
January 1936, Conservation
March 1936, Save the soil
September 1936, Science, grades 7 to 10
November 1936, Spiders
January 1937, What happens when—? (molecular nature of matter)
March 1937, The sea
September 1937, Astronomy and earth history
November 1937, Are they vermin?
January 1938, Homes
March 1938, Electricity and magnetism
September 1938, School science library
November 1938, Waterways in fall
January 1939, What's the difference? (chemical nature of matter)
March 1939, Creeping, sprawling plants
September 1939, Mammal geography
November 1939, Farm-forest facts
January 1940, Fields in winter
March 1940, Waterways in spring
September 1940, Field studies
November 1940, Finer side of life
January 1941, You
March 1941, Outdoor living
September 1941, Indoor studies; Index, vol. 25, no. 2, to vol. 35, no. 1
November 1941, Holes in the ground
January 1942, More about water
March 1942, U. S. minerals and us
September 1942, Wildlife conservation
November 1942, Let's play safe
January 1943, Mastery of air
March 1943, Wild foods
September 1943, Emergency science outdoors
November 1943, Mastery of water
January 1944, Little climates
March 1944, Pounding and cutting tools
September 1944, Cornell nature philosophy
November 1944, Fibers
January 1945, Over the ground
Spring 1945, Cover
September 1945, Outdoor laboratories
Fall 1945, Window laboratories
Winter 1945-46, Let's see
Spring 1946, The story of conservation in New York
September 1946, Outdoor education
Fall 1946, Hedgerows
Winter 1946-47, Microbes
Spring 1947, Salamanders, toads and frogs
September 1947, More outdoor education
Fall 1947, Wildfire
Winter 1947-48, Snow, frost, and ice
Spring 1948, Apple tree animals
September 1948, Let's measure things
Fall 1948, Lawn laboratories
Winter 1948-49, Wood
Spring 1949, Shell-bearers
September 1949, Elementary science library
Fall 1949, Paved desert laboratories
Winter 1949-50, Hunters and hunted
Spring 1950, Fish bait
September 1950, Nature writings
Fall 1950, Fish and fishing
Winter 1950-51, Winter lunches for wildlife
Spring 1951, Wooded laboratories
September 1951, Conservation, a handbook for teachers
Fall 1951, Wet laboratories
Winter 1951-52, Survival in winter
Spring 1952, Reptiles
September 1952, Teachers' number—Index 1941-1952
Fall 1952, The story of conservation in New York (reprint)
Winter 1952-53, Sky laboratories
Spring 1953, Inviting bird neighbors
September 1953, Outdoor nature studies
Fall 1953, Air laboratories
Winter 1953-54, Insect homes
Spring 1954, Woodlands in spring
September 1954, Indoor nature studies
Fall 1954, Fall changes
Winter 1954-55, Science with toys
Spring 1955, Summer nature explorations
September 1955, Schoolroom science center
Fall 1955, Air-borne
Winter 1955-56, Green factories
Spring 1956, Underfoot

Cooperative Extension Service, New York State College of Agriculture at Cornell University and the U. S. Department of Agriculture cooperating. In furtherance of Acts of Congress May 8, June 30, 1914. M. C. Bond, Director of Extension, Ithaca, New York.